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CONTENTS:

	PAGE
Working Hours in America	561
Apparatus for Indicating a Broken Wire in a Multiphase System (*illustrated*)	563
Municipal Electric Lighting in America	563
The Post Office Report for 1896	564
An Emery Wheel Machine for Commutators (*illustrated*) ...	565
The Hartford Electric Light and Power Plant (*illustrated*) ...	566
Manchester Electric Lighting and Traction	568
Rhodin's Electrolytic System (*illustrated*)	569
The Thunderbolt Governor (*illustrated*)	571
Reviews:—	
First Principles of Electricity and Magnetism	572
Traité Complet d'Electro-Traction	572
Correspondence:—	
Municipal Wiring	573
Sterilisation of Impure Water by Ozone	573
Wireless Telegraphy	573
Raworth *v.* Emery on Engines for Electric Traction ...	574
Dynamo Design	575
Dust Destructors	575
The Engineers' Strike	575
Business Notices, &c.	576
Electric Lighting Notes	578
Electric Traction and Motive Power Notes	579
Telegraph and Telephone Notes	580
Contracts Open and Closed	580
Notes	581
City Notes	584
Traffic Receipts	584
Share List of Electrical Companies	585
The New York Fire Department Electrical Rules (*illustrated*)	586
What Niagara can do (*illustrated*)	587
The Protection of Telephone Instruments from Lightning (*illustrated*)	588
Glasgow Telephone Inquiry (*continued*)	589
New Patents and Abstracts of Published Specifications ...	592

THE

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WORKING HOURS IN AMERICA.

APROPOS of the eight hours' question, it may not be out of place to draw attention to the American practice with a view, on the one hand, to convey information, and on the other to correct the impression which prevails in some quarters, and arising, we believe, from a statement made by one of the strike leaders, that in the United States the working week is of 48 hours only. In Australia and New Zealand alone is this the case, as it has been for years, but neither of these countries has ever been in a position to compete with the outside world. The usual practice in the United States is to work 59 hours per week. Work commences at 7 o'clock in the morning, which necessitates obviously a very early breakfast. There is then no stoppage for five hours. The dinner hour is from 12 to 1 o'clock, and another five hours' work ensues until 6 p.m. For five days a week this goes on, and on the sixth day, Saturday, the American workman gets one hour less work. He works only nine hours on Saturday, and the Saturday half holiday is unknown. Owing to the cost of living in America, it is necessary that wages should be higher than in England, and it is estimated that an American employer pays his men about 50 per cent. higher nominal wages. The men work 10 per cent. longer hours, but they get through about double as much work as the English Trades Unionist. There is thus left a considerable margin to meet the higher cost of rent and management, and possibly of fuel and general charges. The broad fact is, that the wages cost of production is very much less than it is in England, and this accounts for the increase in American competition. As regards shop management, the American workman is just as unsympathetic with the boss as is the Englishman, and cares nothing whatever for his worries; but there is a difference. The Englishman pays a set of agitators, who have the gift of oratory, to worry his employers and hinder, by every possible means, the smooth working of the business. The American workman does not do this, but is willing to work by the piece, to attend to as many machines as he can, or to take charge of more machines than he can manage by means of labourers and boys who do the necessary watching and tending, while the skilled man buzzes about setting work, replacing tools, and generally superintending exactly as though he were a foreman in a textile factory superintending a roomful of machines. He cares simply to make money for himself, and leaves the employer to manage the shop and supply tools. He grumbles if he has not supplied to him the best machine tools, and he makes these tools do all they can, and tries to wear them to pieces. One result of this is that they are everlastingly buying new tools in American workshops, and this makes it good for the tool trade, and finds a lot of work for skilled mechanics in tool making. In England, where we continue to use machine tools long after better ones are on the market, the tool trade is consequently starved, and skilled tool makers lose much trade that ought to come to them. This seems foolish policy,

but it is of little use buying new tools when the old ones can easily do as much work as the new ones are *allowed* to do. If a novel tool is brought into an English shop, word is at once sent to the A.S.E. officials, and the machine is as likely as not to form the basis of a strike, or some equally childish dispute. If the general commercial policy of the United States were on a par with their shop methods, it would be absolutely impossible for England on present conditions to compete with America in machine production. Fortunately, Americans are as foolish on such questions as English workmen are in questions of machine working. The hope for the English engineering trade in the future lies in the possible reduction of hours in America below 59, and in the abolition of A.S.E. interference with production in England. There is nothing very particularly striking about the native American workman. He simply is allowed to do his best, and expected to do it, and he does not endeavour to rob the less fortunate unskilled worker of a chance to improve his position, but is glad to help him to do so, and endeavours to make a bit for himself in helping his weaker brother.

The cant hypocrisy of the A.S.E. spends itself in phrases about helping one another, but this faked-up brotherly love is rigidly confined within the A.S.E. ring fence, and no brotherly love inside this ring must interfere with official salaries.

In America, the Trades' Unions confine their energies to looking after the welfare of their members. They have no love for the employers, and no doubt would get all they can out of him; but it is dollars they are after, and they do not deliberately set themselves to make business unprofitable, for this would mean fewer dollars for themselves. The reasons for the very different conditions in the two countries are very probably that trade in America is of comparatively recent growth, and has had to adopt economical methods so as to exist at all. In England matters have become lax, owing to our longer established position, and the workmen have somehow become imbued with a fallacious system of thought, and so the old time enmity to machinery has been revived in a tenfold aggravated form. A hundred years ago there was some sense and reason in machine breaking. There was no precedent that we know of to tell anyone that machinery would not reduce labour to starvation, and it is impossible to feel other than a sincere sympathy with the mob of machine wreckers, who cannot be blamed for smashing what was going to throw them out of work, and all chance of life itself. In 1830, so learned and intelligent body of men as the House of Lords believed that the horse would be abolished by the locomotive. How then can the earlier machine wrecker be blamed? But a hundred years have gone by. No man of sense believes in the bad effects of machinery; but the A.S.E. will have none of it as a means of cheapening production. As *Engineering* recently said, either Trades Unionism as now practised has to go, or British engineering trade has to go. The question is now on its solution, and according as the present struggle turns out will the future be known. The old shops may go on for years, but no new capital will go into engineering if trade disputes continue to be so acute.

American competition is the particular competition on which comparisons are to be drawn. We need enter into no discussion as to whether the purchasing power of American wages are greater or less than that of English wages. Sufficient for the purpose that American wages are higher in cash, and that Americans only receive cash for goods sold here. Therefore the goods have cost more money in wages, or more work has been done for the wages. Clearly it is the latter which enables American goods to compete. Does it not therefore behove Englishmen to take such steps as will maintain the English trade in a position to compete. That they can do so is well known, for Englishmen who go to America are always able to do as well, or better, than natives, and do so where they are free from Union dictation. If they persist in their present attitude English trade must per force slacken off, and the men who strike against nine hours will be then free to emigrate to America and work ten hours in less kindly climatic conditions. In what way will they benefit?

"Newton Redidivivus."

THERE is probably no more enterprising newspaper in the world than the *New York Herald*. We owe a great deal to it, even the discovery of Livingstone; but even the "good Homer nods" sometimes, and so we must not be too surprised when we find that our esteemed enterprising contemporary has discovered a "Sir Isaac Newton *redidivivus*." The surprising part of it, however, is that the discovery has been made in the person of Stephen H. Emmens, whom, from the list of qualifications which he appends to his name, we gather to be a mining engineer, a chemist, an electrician, and an actuary, besides being a member of the Naval Institute and the Military Service Institution of the United States. If our memory does not play us false, we think that this Admirable Crichton might also have added that he is the discoverer of a certain primary battery, which we remember well a few years ago. For obvious reasons, however, it is possible that he may prefer to forget that he was ever identified with such a "discovery." Since then, Stephen H. Emmens has found the United States a more promising field for the operation of his various energies, and so successfully has he felt his way, that he now has the splendid audacity to pose as a modern alchemist. The "Argentaurum" papers, which have recently been published in New York, have created a sensation. The *New York Herald* devoted nearly a whole page to it, stating, *inter alia*, that "nothing more revolutionary than Dr. Emmens's memorial has been advanced in the name of science since the day when Sir Isaac Newton presented to the Royal Society his doctrine of universal gravitation. It is our misfortune that we have not read these wonderful papers, which for $2 can be obtained, cloth bound and post free, to any address. We have seen, however, a table of the contents, and are appalled by the list of subjects which are covered. True to his versatile attainments, Mr. Emmens is versatile in his work. He discusses the defects of Newton's proof respecting the centre of force of a spherical cell, and the reason why the defect in the Newtonian doctrine of attracting spheres has remained undiscovered until now. Gravity centres are distinguished from centres of gravity. The procession of the equinoxes is then introduced, and we are not surprised that the significance of earthquakes should receive some consideration. Saturn and Jupiter, of course, cannot be left out, neither can the author resist having a shot at the obliquity of the ecliptic. After this we are prepared for anything; the cooling and shrinking of the earth's crust, terrestrial magnetism and electricity, and the presence of gold in the ocean; *E pur si muove;* the Error of the Dyne, the variation of products, the infinite concomitant of Newtonian particles, and why two equally heavy Newtonian particles taken together, weigh less than the sum of their separate weights. We put this table of contents down, feeling utterly bewildered. What does it all mean? Is all the world wrong and Stephen H. Emmens, discoverer of a certain primary battery, right? At any rate, one thing is quite certain; we have it in Mr. Emmens's own words in a letter written to *Industries and Iron*. He has discovered absolute proof of the practicability of manufacturing gold. We hear that he has lodged in the United States Patent Office the first of his patent applications bearing upon the transmutation of chemical elements. We are sorry for this, because we had contemplated an expedition to the United States for the purpose of kidnapping Mr. Emmens, and locking him up until he had manufactured a sufficient amount of gold to enable us to buy up everybody else; with, of course, a subsequent introduction to a lethal chamber as a reward for his services, and a security that nobody else should exploit him. It is just our luck. As soon as ever the patent is published, all the world will know almost as much as Mr. Emmens does, and what will be the good of that?

APPARATUS FOR INDICATING A BROKEN WIRE IN A MULTIPHASE SYSTEM.*

Messrs. Schuckert & Co., of Nuremberg, are introducing an apparatus for instantaneously indicating in the central station a break in one of the line wires of a multiphase system. The apparatus is based on the principle of the well known differential gear, shown in fig. 1. It is well known that two coils, as shown in the illustration, will retain their equilibrium just as long as the effect of each of the coils is equal. No matter what the absolute value of the currents may be, the equilibrium of the two coils is only disturbed when the balance between the two circuits is upset. Such an arrangement is well known, and is often used in three-wire systems to indicate where the pressure of the one side is different from that of the other.

Messrs. Schuckert & Co.'s apparatus differs from the above in the fact that more than two coils are used and also that the frame, *d*, figs. 2 and 3, are free to tilt in any direction. In consequence of this mode of arrangement the apparatus will indicate a break occurring in either of the conductors of the multiphase system, the different branches of which carry usually equal or nearly equal currents, because the equilibrium is disturbed when such a break occurs. In

Fig. 1.

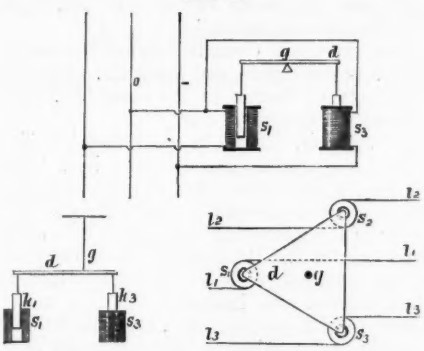


Fig. 2.

Fig. 3.

the three-phase system, three currents, l_1, l_2, l_3, are conducted around three coils, s_1, s_2, s_3, each possessing an equal number of turns. These coils are placed in the three corners of the triangle, *d*. An iron bar, K, dips into each coil. The three bars, k_1, k_2, k_3, are hung in the corners of an equilateral triangle, *d*, which is supported at its centre of gravity, *g*. The equilibrium is preserved only as long as the three coils have currents of equal strength permeating them. It is destroyed as soon as one wire breaks. Then the triangle, *d*, dips, and at the same time causes a bell to ring in the engine room. This apparatus may also be used for two-phase installations having three conductors. In that case, it will be only necessary to change the number of turns on that coil through which the current of the middle conductors passes. This new number of turn in the coil must be made equal to $s/1{\cdot}4$, *s* being number of windings upon the other coils.

MUNICIPAL ELECTRIC LIGHTING IN AMERICA.

Municipal electric lighting in the United States does not seem to have found congenial soil; for some reason, political or otherwise, every attempt to manage central stations by municipalities has created strong adverse criticism and unveiled hostility, for which good reasons, unfortunately, have too often existed.

Detroit, Mich., is one of the places where a tendency has been shown to municipalise all public necessities. We suppose it ranks in this respect as the Glasgow of the United States. One of the first projects entered upon by the city was the establishment of a corporation electric light plant, as we should call it; but it is confined to public lighting, and therefore stands more in the position of what Londonderry lighting does than following the ordinary routine of supplying all comers, and making a good business out of the transaction.

The plant is capable of supplying 2,000 arc lamps of 2,000 C.P., of which 1,564 are normally in operation, and 3,000 incandescents of 16 C.P. The units sold last year were as follows:—

Arc lighting	2,716,628
Incandescent lighting	263,784
Total units	2,980,412

Thus the output reached very close upon 3,000,000 units—a figure which makes the station a large one compared with most of those in this country.

The arc lights ran on an average of nearly 10½ hours per day. The shortest average runs were in the month of July of a little less than 7¼ hours, going up to 13½ hours as an average during the month of December. The arc lighters were run for a total period of 3,791 hours during the year, which comes very close to the period per annum for all night lighting in this country.

The annual cost per arc lamp in round sums is given below:—

	£ s.
Generation	5 3
Trimming	3 18
Repairs and maintenance... ...	3 6
Management	1 4
Depreciation	0 9
Rates and taxes	1 0
Interest	3 14
	£18 12

The total cost was approximately £19 per arc lamp per annum, which seems very high, considering that the output was nearly 3,000,000 units, and the load an all night one of the most favourable character. It is but slightly less than the average contract price paid to private companies, yet we are told that the plant is "very well built and organised." If this be true, it is not surprising that the opinion should gain ground that American municipalities, "as a rule, have nothing to gain by building their own plants." Why what proves so good a thing, and gives such excellent results in the old country, should not work out right in the new we do not profess to understand. Disinterested and capable management, coupled with reasonably good plant, ought to be able to yield proportionately good results in each case.

It is interesting to remark that the Detroit Public Lighting Commission have only calculated depreciation on the boiler plant; everything it assumes is kept in a state of perfect repair, and therefore no depreciation need be allowed. This is illogical, but it is on a par with the reasoning of one of our local authorities which equally ignores the difference between maintenance and depreciation.

The plant owned by the City of Detroit appears to have a capacity installed of about 1,150 to 1,200 kilowatts, and cost about £152,000. The capital cost per kilowatt works out just below £130, so that the figure is, if anything, below the average of London stations, and not out of the way in any case. This is rather curious, considering that we are constantly being told that everything is so much more expensive in the United States. Taken per lamp, the capital cost gives about £70 per arc and £4 per incandescent. In comparing these figures, it must also be noted that the consuming devices—in this case arc and incandescent lamps—appear in the capital cost.

Taking out the separate amounts, we get the following round figures:—

Site and buildings	£38,000
Electrical plant	13,300
Steam plant	22,400
Conduits and cables	47,000
Columns and arc lamps	29,700
	£150,400

The sum for site and buildings is high to our ideas, but does not exceed what has been paid for more than one London

* Dingler's Polytechnisches Journal and abstracted in the New York *Electrical Engineer*.

station. The items generally run at about the figures that would be spent in this country for similar work done in something like the same way. In any event they are certainly of interest as indicative that it is the running and not so much the capital that is high in America.

THE POST OFFICE REPORT FOR 1896.

"It is not right that the ordinary correspondence of the country should be delayed while the staff of the Department are endeavouring to solve the puzzles which are set them by careless and eccentric persons!"

So ends those entertaining episodes with which it has been the practice in former reports to endeavour to enliven the mass of prosaic figures and facts of which these reports have at all times to tell. The Post Office Department is a progressive department—always expanding, always gathering within its realm some fresh field that it may meet some existing want. The details of the present document are dry enough; there is absolutely nothing beyond the satisfactory progress of that energetic branch of the public service which it controls to offer to the reader the least gratification. But to those who are interested in this progress there is much that will repay them for the reading; and this is especially so with respect to the telegraph branch. Of the 2,314,022 money orders, no less than 160,470 were executed by telegraph—an increase of 7,152 on those of the previous year. Various concessions, although not of a radical character, have been made in relation to the issue and payment of these orders, all calculated to extend the use of telegraph money orders; and the Postmaster-General announces that he is also negotiating with foreign countries for the exchange of this class of order. In dealing with the Savings Bank Branch, it transpires that the number of telegraphic withdrawals was for 1896, 102,553, as against 78,818 for the preceding year. The largest number on any one day, viz., on December 24th, was 924.

Turning to the Telegraph and Telephone Department, we note that the number of telegrams forwarded was 79,423,556, being an increase of 583,946, or 7·4 per cent. over the number for 1895. It is pointed out that this number exceeds by 2,000,000 the number of letters, other than "franks," passing through the post in the year in which the Queen came to the throne.

The revenue from inland telegrams was £2,070,045, as compared with £2,046,456 for the previous year; and the average value 7·58d. per telegram, as compared with 7·61d. for the same period, 1895.

In foreign telegrams there was a decrease of 393,851, or 5·87 per cent. This decrease, it is thought, was due to a lull in the speculative transactions on Continental Bourses. Of Press messages there was a decrease of 77,945, or 1·31 per cent, the total number being 5,837,701. The average weekly number of words contained in these telegrams was about 13,471,618. Telegrams transmitted under the free message terms acquired by certain of the railway companies amounted to 1,371,406, an increase of 2·43 per cent. as against an increase of 27·74 for the preceding year.

London local telegrams show an increase of 343,072, or 4·92 per cent.

The transfer of the trunk lines acquired from the National Telephone Company commenced on April 4th, 1896, and was completed on February 6th of the present year. The company is complimented for the "ready and able assistance in overcoming many of the difficulties" arising out of this work displayed by their officials. The mileage of trunk wire erected by the Department itself, up to the end of the year, was 19,620; the mileage transferred from the National Telephone Company was 29,000; making, with the 4,180 miles in the course of construction, a total mileage of 52,800. The Postmaster-General here remarks upon the fact that the mileage of wire taken over by the State in 1870, at the time of the transfer of the telegraphs, comprised no more than 48,989 miles of wire. The telephone system now consists of over 880 separate trunk circuits, supplemented by more than 2,000 circuits between post offices and the National Telephone Company's exchanges. To meet the cost of these lines, an expenditure of £300,000, in addition to the £1,000,000 authorised under the Telegraph Act, 1892, has been sanctioned.

The main arteries from London to the provinces having been already occupied by wires, an underground line is to be laid down between London and Birmingham. This work is estimated to cost £165,000, and of this £65,000 will be spent during the current year. This underground route, when completed, is to provide for a telegraph service, and so set free certain aerial wires now in use for telegraph work, in order that the pole space occupied by them may be available for telephone circuits. It is perhaps needless to say that the cable to be employed will be that in which the conductors are insulated with paper, enclosed in lead tubing. Another reason advanced for the adoption of this underground route is "the fact that the country to be traversed by the line is the scene of the storms which are most disastrous to the telegraphs. These storms follow a course which may be roughly described as extending from the Bristol Channel to the Wash." It is thought that the new underground line will obviate the risk of total interruptions, "and the whole system of the country will thus be rendered more secure."

In coast communications much progress has been made on the Devon, Cornish and Welsh coasts, on the north-east coast of England, and the coasts of Scotland and Ireland. The maintenance of the lightship cables still presents some difficulties; while "the experiments which are being made with a view to ensuring communication with lightships by other means than continuous cables have not, as yet, been brought to a definite conclusion."

At the joint expense of Great Britain and Germany a cable, consisting of four conductors, and about 224 knots in length, has been laid between Bacton, on the coast of Norfolk, and Borkum Island, in Germany.

From the foregoing, it will be seen that the Telegraph Branch of the Department has not been idle. While the traffic side has had its hands full of message work, the engineering officers have been equally well engaged. We have no knowledge of the number of wires which the underground line between London and Birmingham is to carry, and probably this point has not yet been fully determined, but the result will be watched with interest. The cost must necessarily be heavy, but the maintenance, provided the unforeseen does not happen, will possibly be correspondingly light. The most casual observer must see that all the main public roads out of London on which it is possible to erect a line of poles are now occupied, and no doubt difficulties in the shape of wayleaves hamper the officials for some distance, but we should have thought that some of our railways might yet have found room for additional wires if required, and that such a route might prove even more accessible and more convenient than a highway route. There is, however, sound judgment in trying an underground line with a view to obviate the effects of storms. These have not of late years dealt such devastation in our telegraphs as of yore; still, under certain extreme conditions, we know something must succumb—poles or wires. We shall now, in course of time, be able to gauge the value of an underground route.

We do not know how it is, but though the Telegraph Department deals annually with more work, the receipts increase, and one would say they must possess a margin of profit over the increase of expenditure; yet the result, from a commercial point of view, is unsatisfactory. Again we are told of a loss on the telegraphs of £140,714. The Post Office Department, as a whole, earns on the year a profit of £3,893,823, a magnificent sum, speaking volumes for the progress of the country; but it is reduced by this said loss on the Telegraph Account by £140,714 to £3,753,109. One would imagine that, increasing as is the telegraph business year by year, the time had arrived when it would be a paying service. The statistics furnished, however, seem to forbid all hope of any such result. The percentage of combined salaries and wages to combined revenue has increased from 38·66 in 1886-7 to 45·62 for 1896-7, and the percentage of combined salaries and wages to combined expenditure has increased for the same period from 50·94 to 60·70. On the other hand the increase in the total number of telegrams on the number rendered for the year 1886-7 has been 58 per cent., and the percentage of increase on the total value of telegraph work performed, 43.

The remarks of the Postmaster-General in relation to the findings of the Committee appointed by the previous Post-

master-General "to inquire into the remuneration, prospects, and conditions of employment of any classes of servants of the Post Office, other than the clerical staff in the chief offices," will no doubt prove of interest. We quote the following :—

It is with great satisfaction that I have seen the acceptance of the whole scheme proposed by the Committee and recommended by myself, even though the immediate cost to the taxpayers is estimated to be nearly £139,000 a year, and the ultimate cost nearly £275,000 a year.

I have noticed with pleasure that the Committee acquits the higher officials of the Department of favouritism in the matter of promotion, and of unfairness and undue severity in awarding punishments and in enforcing discipline. I do not imagine it possible that any Postmaster-General, knowing the care exercised in such matters, could have supposed for a moment that charges of this kind were well-founded, but it is none the less satisfactory that their refutation should be authoritatively placed on record. The Committee add that in so large a service individual cases of favouritism must occur, but they find no want of vigilance in the heads of the Department to prevent such occurrences, and your Lordships may rely upon the continuance of all possible care in this respect.

Again, the Committee reject any general charge of overcrowding post offices, or leaving them in an insanitary condition, though they observe that, in some few cases, owing to the rapid development of the work and increase of the staff, matters may not be in all respects satisfactory. . . . . The state of the General Post Office (East) is engaging my earnest attention, and no time will be lost in devising and applying the necessary remedies, which must, however, in any case, take considerable time to carry out.

The rapid development of Post Office work in recent years has undoubtedly been the cause of many of the difficulties which have arisen in the organisation of the staff.

AN EMERY WHEEL MACHINE FOR COMMUTATORS.

What is more irritating to the electrical engineer responsible for the the generation of electricity for public and private use, particularly at a constant pressure, than continual sparking at the brushes by reason of flats on the commutator? Of late years several remedies have been tried with more or less success in mitigating this evil, such as the application of various mixtures of lubricants and conducting agents, but these as a rule only afford temporary relief, and the time soon comes when the application of emery paper or a smooth file is necessary.

This cycle of operations continues to go on until the surface of the commutator, which becomes day by day more untrue and elliptic with use, is subjected to the slide rest and turning tools.

In the case of small armatures, their removal for the treatment of the commutator in the lathe is often a matter of comparative ease and the result cannot be improved upon by any alternative method, but in the case of larger armatures their removal is unpracticable without taking into consideration the question of expense. Accordingly, holes are drilled and tapped in the dynamo bedplate to receive the bolts holding the framework of the slide rest in close proximity to the commutator, and turning is then proceeded with under difficulties.

Without deprecating this method too roundly, it must be admitted by those who have been driven to adopt such a method that it is a clumsy and imperfect one, partly due to the time and labour expended, but chiefly to the irregularities of speed obtained when the cut of the tool is increased or diminished. Herein lies the chief difficulty, ever likely to increase with the demand for high speed engines and direct coupled dynamos.

The accompanying photographs show an emery wheel machine mounted on a special bedplate, which is clamped in position to the bedplate of a Willans engine and dynamo set (250 H.P.), and also the general appearance of the machine when detached, showing adjustable pedestal to relieve any jarring of the bedplate.

The emery wheel, 12 inches in diameter, is driven by a small motor, mounted on a suitable base, by means of a narrow belt passing over the emery wheel pulley, which in this case is 2 inches wider than the commutator.

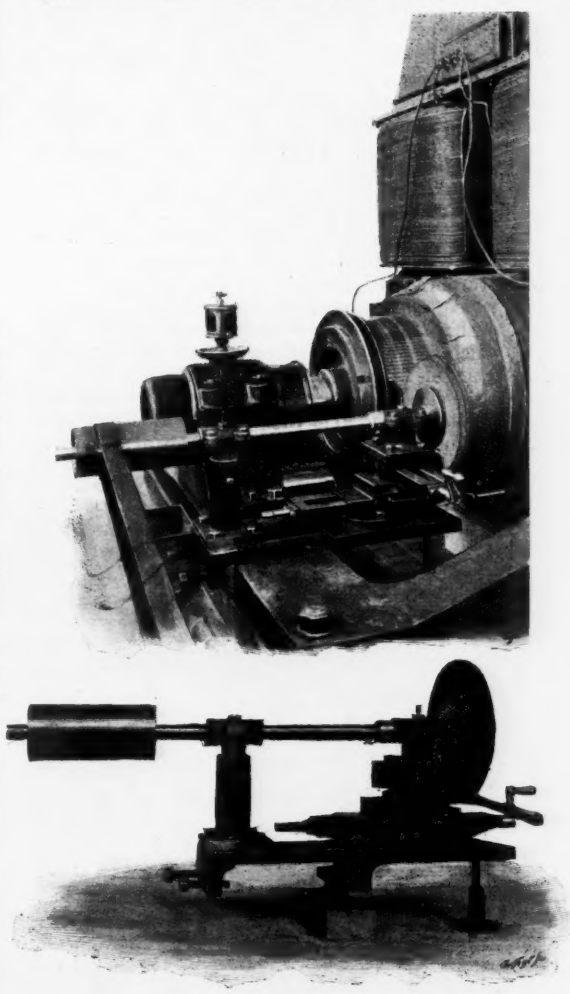
The spindle is mounted on two pedestals with swivel bearings, and is free to move in either direction relatively with slide-rest through pulley bearing, and being held in position by collars on either side of slide-rest bearing, can be rotated with equal freedom whether parallel with centre line of armature or not—hence the emery wheel can be brought to bear on the commutator at any point in its width.

The pulley is keyed to the shaft in which is cut a lengthy slot, in order that it can be set to suit the width of commutator and at the same time reduce undue strain on the shaft by minimising the distance between the bearing and travel of belt.

The motor is wedged or bolted in a suitable position with the belt slightly taut—the former method is preferable in central stations—and any undue slackness of the belt when in operation can be remedied by readjustment of wedges or a simple belt tightening gear. As a rule neither of these precautions are necessary.

When the dynamo and emery wheel are run up to speed, necessarily rotating in the same direction, the latter should have a slight clearance from the commutator, and the cut then adjusted gradually.

A special form of wheel is used for soft metal work, presumably a compound of emery and stone, the peripheral speed of which is limited to 4,000 feet per minute. It is



bevelled on one side to a thin edge, is used perfectly dry, and different sizes and grades can be substituted with perfect facility. A fine grade emery wheel is used lastly for polishing.

The commutators of the continuous current dynamos for high and low tension working submitted, after some three years' central station wear, to the treatment of this machine, show that this method has been entirely successful, both as regards convenience and time, particularly the latter, since *no holes need be drilled* in the dynamo bedplate for fixing the machine rigidly; the turning can be entrusted to any workman accustomed to the careful treatment of dynamos, and the result will give assurance to the engineer that the labour, expended in a few hours from start to finish, has not been wasted in vain.

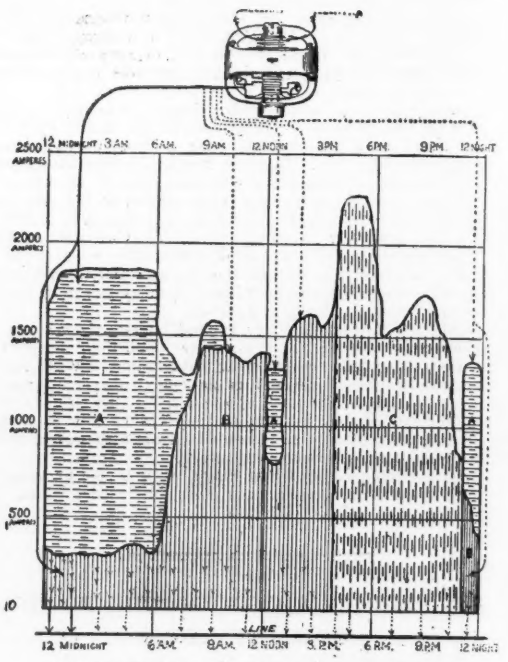
The machine was designed by Mr. H. H. Perry, Chelsea Electricity Supply Company, and constructed by Messrs. Honeywood & Austin, Globe Works, Harleyford Road, Vauxhall, who are busy in executing orders for similar machines.

A slight modification only is required for the fixing of this machine to high pedestal dynamos and rotary transformers, while special motors can be fitted to drive the emery wheel shaft direct, but with the latter arrangement the cost of the machine is, in consequence, greatly increased.

THE HARTFORD ELECTRIC LIGHT AND POWER PLANT.*

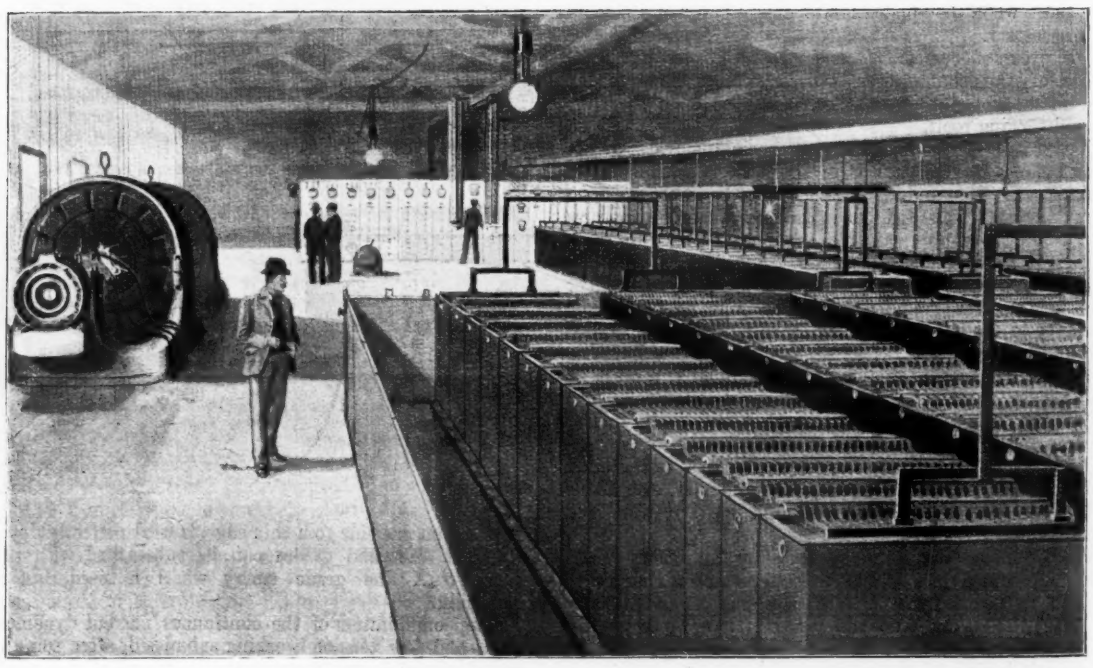
With the completion of the new plant of the Hartford Electric Light Company and the leasing of the old plant of the Hartford Electric Light and Power Company, the citizens of Hartford are able to boast that they use more electric light and power than any other city in the United States and that they have one of the best electrical systems on the continent.

The original dam on the Farmington River was built in 1889. The site was 10·8 miles distant from Hartford, and at that time the success of long distance power transmission was somewhat problematical. The dam, 18 feet in height, was accordingly built of wood, with a vertical face and wooden abutments. When it was decided to enlarge the electrical system of the city last year, five feet were added to the height of the dam, bringing it up to 23 feet, and the wooden abutments were replaced by a solid construction of granite. The water is led through four pairs of 36-inch horizontal turbines by means of large steel flumes 8 feet in diameter, which pass through the abutment and inclose the turbines, as shown in the accompanying engraving. The turbines, which are of the McCormick and Rodney Hunt type, are arranged in pairs upon a common shaft, the water entering at the ends of the casing and discharging centrally through a draught tube. The total capacity is 1,600 horse power. The turbines are controlled by Lombard governors, which compress air into a receiver for use in shutting down the gates, should the load be suddenly taken off during operation. If the turbines should commence to race, the governor automatically releases the compressed air and shuts down the gates in a few seconds' time. Two pairs of turbines are belted to each generator, the generator pulley being double crowned for this purpose. There are two 600-kilowatt



STATE STREET STATION LOAD DIAGRAM.

22-pole generators made by the Westinghouse Electric and Manufacturing Company. They are run at 325 revolutions per minute, and the frequency of the current is 60 cycles per second.

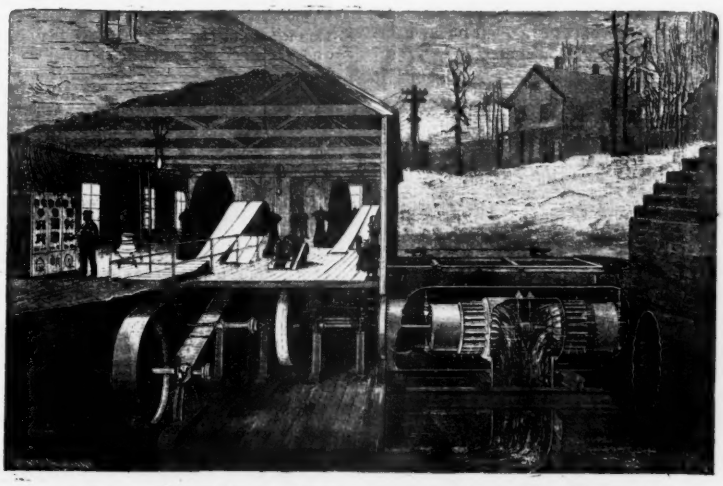


State Street Station.—Rotary Transformers, Switchboard, and Storage Batteries.

The current at 500 volts is raised in transformers to 10,000 volts for transmission to the city, 10 8 miles distant. It is brought in over six No. 0 copper wires, whose combined cross section is about ¼ of a square inch. It was decided to use six wires in place of three in the three-phase

* *Scientific American.*

transmission (two being connected in multiple on each phase), because by this arrangement the lines used in the former plant could be utilised with better economy. At a distance of a little over half a mile from the Pearl Street station, in Hartford, the wires are carried underground and connected to three No. 0000 cables which run direct to the station. The loss of power in transmission is less than 10 per cent. for the 10·8 miles. By reference to the engraving of the power station at Farmington, it will be seen that the power is transmitted from the turbines to the generators by belting, the distance between the respective shafts being 50 feet. As a striking illustration of the relative economy of electric as compared with belt transmission, it may be mentioned that the loss in this 50 feet is 10 per cent., or equal to the loss on the whole 10·8 miles of electrical transmission. The lines are protected from lightning by banks of Wurts arresters and choke coils. The former are mounted in racks, one rack being placed in each phase of the circuit both at Farmington River and the Pearl Street station.

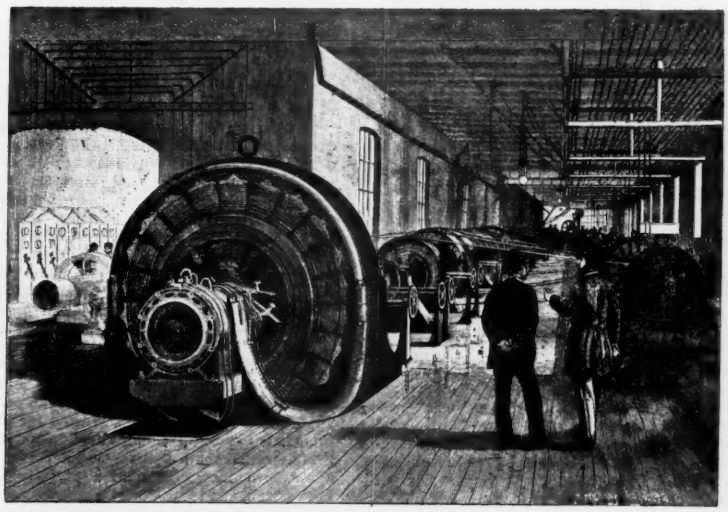


Turbines and Generators at Farmington River Power House.

At Pearl Street station the 10,000 volt three-phase current, which was used for the long distance transmission as being best adapted for the work, is reduced to two-phase, 2,400 volt current. Here the electric energy is used in three different ways:—

1. It supplies current to the alternating current lighting and power system of the city.
2. It supplies current to the rotary transformers at the State Street station.
3. The current that is not used for the above purposes operates a 600-kilowatt motor at the Pearl Street station.

In the alternating current distribution at Pearl Street mentioned above the lighting circuits are run at 1,200 volts, on the single-phase system, and the light and power circuits at 2,400 volts on the two-phase system. Under the present system the current that is not derived from the Farmington power house is furnished by the engines and generators at Pearl Street, which were formerly the property of the Hartford Electric Light and Power Company. This plant consists of a 1,600-horse-power Cooper-Corliss compound condensing engine belted to one end of a shaft at the other end of which is a 600-kilowatt Westinghouse generator. This line of shafting serves also to operate the series-arc dynamos and two 200-kilowatt generators that supply current to one of the suburban street railways.



Pearl Street Station.

The 600 kilowatt generator may operate either as a motor or a generator. It is at all times connected with the switchboard, so that when the water power is not equal to the demands of the alternating system (as often occurs during the hours of maximum load) the motor at once becomes a generator driven by the engine and supplies current in multiple with the Farmington power house generators. In the summer time the plant at the river can only be run for 12 hours out of the 24, and during this period the steam power plants acts as an auxiliary. Moreover, in case of a breakdown of the water power, the same plant would be available to furnish the city's needs.

The presence of the 600-kilowatt motor in the station also allows the voltage to be varied on the alternating system without reference to the power station. The voltage may be made to vary through a wide range by varying the field excitation of the motor, and this is done by introducing a lagging current into the transmission line. An induction motor serves to start the 600-kilowatt motor, the former being thrown out of the circuit as soon as the correct speed is obtained. As the motor is built to work at a 2,400-volt pressure, no special transformers are required when it is operated as a generator.

The State Street station, of which we present an interior view, is said to contain the largest storage battery in the United States. At the far end of the room will be noticed the large marble switchboard, which is 8 feet in height, and when completed will measure 50 feet in length. To the left are the two rotary transformers and behind the switchboard are four stepdown static transformers. The 2,400-volt current which is delivered from Pearl Street station is received by the rotaries and their accompanying transformers, which change it from alternating two-phase and deliver it as 240-volt direct current to the three-wire system.

The current received from Pearl Street station is controlled and recorded on the panel on the left. Upon another panel are the switches and meters which receive the current from the rotary transformers. They are provided with automatic circuit breakers, which prevent the pressure from rising above a certain point. The tall metal frames standing up above the switchboard at the centre contain vertical screws, by means of which "end cells" in the storage battery can be cut in or out of the circuit, according to the variation of the demand. On each side of this regulator are the discharge panels. To the

right again are the switches which control the underground feeder circuits.

The storage battery, manufactured by the Electric Storage Battery Company, of Philadelphia, contains 130 cells, 65 on each side. The cells are made of oak and are lined with lead, and each cell contains 31 negative and 30 positive plates. The negative plates are of the chloride type, the positive plates being the Manchester type of Planté plate. The capacity of the battery is a discharge of 1,700 amperes on each side for five hours. The total weight of the cells is 300 tons, and each cell measures 2 feet × 5 feet × 4 feet high. When the battery was erected it took 10 car loads, or 180,000 lbs., of sulphuric acid to charge it. The switch-board connections are arranged so that the battery is at all times connected with the distributing bus bars, whether it is charging or discharging, or when the battery and rotary are supplying current in multiple to the lines. As a result of the connection of the alternating to the direct current system through the rotary transformer, the battery is able to provide for fluctuations in either of the systems.

The accompanying load diagram will assist the reader in understanding the part played by the storage battery in the Hartford system. The figures on the vertical scale show the amperes and the horizontal scale the time for 24 hours on December 12th, 1896. The battery has a capacity of 500 horse-power for five hours. It is capable of running 1,000 incandescent lamps for 34 hours, or 34,000 lights for one hour. The shaded space marked A shows the current that was discharged into the battery from the wire through the rotary transformer. The space marked B shows the current that was sent direct from the transformers to the lines, and that marked C indicates the current sent into the lines from the battery. It will be seen that from 12 p.m. to 6 a.m. the consumption was about 350 amperes. Between 6 a.m. and 8.30 a.m. it rises rapidly to over 1,500 amperes. At about 8 a.m. the current from the Farmington River station, which has been passing into the battery, temporarily assists the transformer current, as shown by the horizontally shaded portion of the diagram at the top, at this hour. The demand then drops slightly until near noon, when it falls suddenly to 750 amperes. This is caused by the large number of lights and motors that are shut off for the dinner hour. The surplus current meanwhile flows into battery. From 1 p.m. to 3.30 p.m. the whole of the Farmington current goes to the lines. From 3.30 p.m. to 11 p.m. the lines draw all of their current from the battery, and at 11 p.m. the charging of the battery again commences, and the current for the lines is drawn from the transformers. By 3.30 p.m. the battery will be fully charged and the 1,000 horse power from Farmington River can be utilised at Pearl Street station. With the battery at State Street fully charged, the Farmington current running the Pearl Street generator and the Pearl Street engine also running, the total horse power available would be about 3,000.

We are indebted to Mr. William Lispenard Robb, the electrical expert of the company, and Mr. R. W. Rollins, superintendent of the works, for courtesies extended during the preparation of this article.

MANCHESTER ELECTRIC LIGHTING AND TRACTION.

The following is a brief and general report of the deputation recently appointed to visit the Continent on the results of inspection of Continental stations:—

The object of the inspection was to ascertain the latest Continental practice in electric lighting, and to learn the extent to which electric traction was used, and the various methods by which it was applied, and especially if possible to ascertain how the problem of supplying current for both lighting and traction was dealt with.

The first point which stood out prominently was the employment of slow speed dynamos, coupled directly to slow speed engines. This practice is almost universal on the Continent, there being very few instances of belt or rope driving. Secondly, it was clear that the tendency was to have few machines of very large power rather than a number of small machines. In this connection, it is satisfactory to note that the new generator of 2,500 H.P. now on order for the Electricity Committee is on these lines, and, indeed, is an advance on anything seen on the Continent, since the number of bearing surfaces is considerably reduced by placing the dynamo between the high and low pressure engines, while in point of size it is two and a half times as large as any seen.

As regards boilers. Tubular boilers were almost universally employed, but on the other hand, it was in nearly all cases stated that the reason for this was economy of space, and that boilers of Lancashire type would be preferred on other grounds. This also is a satisfactory confirmation of the soundness of the work already done at the electric light station in Manchester.

One result of the investigation is to show that electric traction is fast superseding all other means of hauling trams. Wherever electric traction has been introduced on a small scale, the system is being largely extended, and the use of horses is being entirely abandoned. Electric traction is not only preferred to horse traction, but to all other forms of mechanical propulsion, even the Serpollet steam system in use in Paris, and which appeared so promising, is being abandoned in favour of the electric system.

The essential elements common to every system of electric traction are an electric generator driven either by steam or water-power, and an electric motor fixed upon the tramcar geared to the axle of the wheels, and causing them to revolve; the difference between the various systems of electric traction is comprised in the various ways of establishing the connection between the generator and the motor. The most direct and simplest method consists in connecting one pole of the generator to the tramlines, and the other to a wire suspended over the middle of each track, and carried on insulated supports. This system is known as the overhead trolley system.

Next in order of simplicity and directness comes the underground conduit system. In this, each pole of the generator is connected to an insulated conductor carried in a concrete culvert beneath the roadway. Connection with both conductors is established by means of a contact making device known as a "plough," which enters the culvert through a slot running longitudinally in the same direction as the tramlines.

The third system is as simple as either of the two preceding ones, but it is less direct. It consists in charging secondary batteries or accumulators from the generator, which accumulators are fixed on the car, and afterwards give out current to the motor on the car. The electrical energy is thus stored in the accumulators, and no direct connection is necessary between the generator and the motor.

The fourth system is that known as the closed conduit system. In this, one pole of the dynamo machine is connected to the rails, and the other is connected in succession to a series of metal plates between the tramlines, the connection being established automatically by the car as it moves onward. This system is as direct as the trolley or slot system, but it is much more complicated, and is very liable to become deranged.

All systems of electrical traction fall broadly under the four heads named above, but there are endless differences in detail. Thus, with the trolley system the overhead wire may be supported on posts fixed either in the middle of the roadway or at the side, arms projecting from the posts over the tracks; or it may be carried on wires known as span wires, stretched across the track and attached either to the buildings or to two posts without arms. The wire may be fixed over the centre of the track, or near one side, the latter being known as the side trolley system. Contact may be made with the wire either by means of a wheel, known as the trolley wheel, carried at the end of a long arm fixed on the roof of a car, or by means of a metal bow also carried on the top of the car.

Again, in the underground slot system, the slot may either be at the side, one rail forming one side of the slot, or it may be midway between the two rails of each track, a third line of metal being thus necessary for each track.

In the accumulator system, the batteries may be removed from the cars for charging, or they may be left in the cars. In certain cases, the accumulator system is combined with the trolley system, and the accumulators are charged from the overhead wires in those portions of the city where it is fixed, while the electrical energy so stored in the accumulators is used to run the cars over the lines in that portion of the city where overhead wires are not allowed.

Comparing the advantages of the various systems, there can be no question that the overhead trolley system is by far the cheapest to construct, costs less for maintenance than any other system, is the simplest to operate, and the most easily repaired. It is much less liable to interruption than either the underground slot system or the closed conduit system.

The accumulator system is extremely reliable, but the expense attendant on its introduction throughout the whole of the system of tramways is prohibitive, while if it be adopted for certain portions of the city, the working expenses are largely augmented, on account of the great weight of the batteries having to be hauled over the whole of the lines, whether the accumulators are furnishing current or not.

The underground slot system, though as simple to work as the overhead trolley, is very much more expensive, and possesses the serious disadvantage that it entails an entire cessation of traffic over the portion of line being converted for at least three weeks during its construction. The closed conduit system, though very attractive in theory, is not at present sufficiently developed to admit of its adoption being recommended, as it is not capable of dealing with heavy traffic, is liable to fail, and may give rise to shocks fatal to animals, and unpleasant to human beings.

Inquiry and observation show conclusively that on the Continent, wherever possible, the overhead system with either trolley or bow is employed. Other systems are only resorted to when the overhead is forbidden from æsthetic considerations. These considerations doubtless have weight when streets such as the principal streets of towns like Paris or Berlin are in question; but in the case of a great commercial city like Manchester, where cheap transit is a paramount consideration, and where an interruption of the heavy traffic would be fraught with disastrous consequences, there appears no necessity to insist upon the streets being kept absolutely free from overhead wires. Again, the overhead construction has been brought to such a

state of perfection, that the objection on æsthetic grounds is extremely small; indeed, there are probably not half a dozen streets in the finest cities, architecturally speaking, in the world in which it could be held to be a disfigurement. Certainly, in our opinion, it would be none in the busy commercial streets of Manchester in which the trams at present run.

A further advantage of the overhead system is that it lends itself very readily to the combination of street lighting and electric traction, since the same posts which carry the overhead wires may be used to support the lamps without appreciable extra expense.

Traction by means of accumulators has received very considerable development on the Continent, and there can be no doubt that it has been proved to be commercially successful as well as practicable, from an engineering point of view. At the same time, it is unquestionably more expensive than the trolley system, both as regards capital cost and cost of maintenance, the latter being very heavy indeed.

Passing on, now, to the question of the supply of current for both lighting and traction purposes, there can be no question as to the economy of combining the two. In the first place, the traction load is one extending over long hours, and the machinery used for the production of current for this purpose can be looked after by the same men, who must of necessity be in attendance ready to run the lighting plant if required. Further than this, by combining the two stations, there need not be so many machines held in reserve, since the reserve machines can be common to the two systems, it being extremely improbable that there would be a breakdown on the lighting and traction machines at the same time. The same remark applies also to the boilers, and another very large source of economy arises from the fact that the loss from radiation from the steam pipes can be very greatly reduced by supplying both sets of engines from the same steam range. This economy may not at first sight appear important, but as a matter of fact the loss from radiation from steam pipes is extremely large, and this alone would warrant the combination of the two stations. Other sources of economy are management and saving of land by the concentration of the plant.

The plant already put down at the generating station in Manchester is exactly suited to the production of current for electric traction, and by far the greater proportion of the tramlines could be worked from the existing site. Some of the longer lines, however, could not be worked directly from the present station, but the provision of current for lighting purposes over so large an area as that of Manchester, together with those of the outlying districts, which have already agreed to take a supply from the city, necessitates a high pressure generating station, and this would enable the question of electric traction to be dealt with with perfect ease over the whole of the tramway system. The scheme by which the engineer proposes to deal with the problem has already been set forth in his preliminary report of August 18th, 1897, and it is interesting to note that this system is that most largely used on the Continent, viz, high pressure generation with rotary transformers delivering continuous current for lighting and traction. This system is working with apparently great success at Rome, Buda Pesth, and Milan, while it is just on the point of being put into operation at Hanover, and a similar scheme has been adopted for Munich.

To sum up, it would appear that the overhead trolley system with span wires attached to posts fixed along the sides of the streets is the most suitable for Manchester, and these posts could be conveniently used to carry electric arc lamps for lighting the principal thoroughfares. The greater part of the current for working the tramways would be supplied from machinery erected on the land already purchased in Bloom Street adjoining the existing station, and also from the present plant, while those lines which are situated at too great a distance from the generating station would be supplied from the new high pressure generating station, which is necessary for the lighting of the whole city area.

Electric Lighting.—The deputation were much impressed with the large amount of street lighting to be found in the Continental cities. Not only in the cities which were visited, but it was noticed that most of the small towns passed through en route were lit with arc lamps, showing that electric street lighting was being almost universally adopted. Railway stations of moderate size were nearly all lit with arc lamps.

The systems of arc lighting in the streets depend entirely on the width and character of the streets or squares to be lit, and no rule can be strictly laid down. It was evident, however, that where possible the various cities were adopting arc lamps in the centre of the streets, suspended by cross span wires fixed by rosettes to the buildings on each side, or from span wires fixed from vertical posts on each side of the street, the arc lamps being drawn to the side of the street and lowered down to the footpath for cleaning and re-trimming.

Where tramlines were laid, the general rule was for posts to be fixed with arc lamps fixed vertical on posts or overhanging from the curved head of posts. In several of the cities visited, these side posts have simply taken the place of the gas lamps which have been removed. In cities where rosettes are fixed to the buildings, and span wires and centre lamps, the footpaths are left free from any obstruction whatever. This was specially noticeable in Milan and Cologne.

The deputation strongly recommend that street lighting by electric arc lamps be extended in Manchester for the winter of 1898-9. They recommend that Downing Street, London Road, Piccadilly, Market Street, Victoria Street, and Great Ducie Street as far as the Assize Courts, Deansgate as far as Peter Street, Peter Street and Oxford Street to All Saints, Portland Street, Whitworth Street, Princess Street, to Albert Square, John Dalton Street, and King Street, be equipped with arc lamps.

That in view of the introduction at an early date of electric traction for tramway purposes, the system of arc lighting should be as follows:—

Where the tramlines are laid, steel posts should be erected on each side of the street with arc lamps fixed on same.

That the steel posts should be prepared to receive cross span wires to carry the overhead trolley wires if the overhead system is adopted in Manchester.

In the streets where there are no tramlines, the arc lamps to be suspended in the centre of the streets and carried by span wires. These span wires to be fixed by rosettes to the sides of the buildings if permission can be obtained from the tenants and landlords, and if the permission cannot be obtained, steel side posts be erected, and the span wires be carried from them.

Generating Stations and Installations.—The deputation were much impressed with the manner in which the electric installations in the various cities had been carried out. The workmanship and design of the engines and electric appliances were extremely good, and silent working and steady running seemed to be the order of the day. It was evident that cleanliness of machinery and buildings were made a special object of the management.

Future Extension of Plant.—That as the whole City of Manchester and some of the outlying districts have to be lit by electric light under the Act of Parliament, and that the information gained by the deputation during their recent visit to the Continent has shown them clearly that the current can be transmitted long distances without much loss of current by several systems, steps should be at once taken for the acquiring of a site for a new generating station, where land is cheap, and water convenient for condensing purposes. This generating station to be utilised both for lighting and traction purposes.

This report, which is dated October 11th, is signed by

Lloyd Higginbottom, *Chairman Electricity Committee.*
John Phythian, *Deputy-chairman Electricity Committee.*
C. H. Wordingham, *City Electrical Engineer.*

October 11th, 1897.

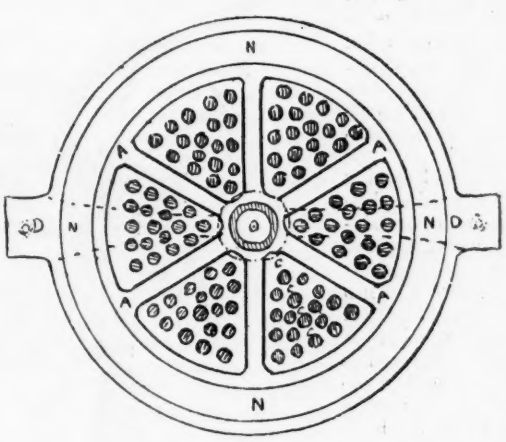
RHODIN'S ELECTROLYTIC SYSTEM.

At the invitation of the Commercial Development Corporation, Limited, we had the pleasure of inspecting Mr. Rhodin's electrolytic apparatus at the Savoy Hotel on Tuesday last.

The advantages claimed by the inventor are :—

"The process is a continuous one with a single anode chamber, costs less to construct, and gives results which far exceed any existing process.

"The construction of the apparatus is such that it lends itself perfectly to the application of heat, a most important



Plan.

point, because the quantity of work which can be accomplished by the current when the electrolyte is hot is very much greater that when used on cold solutions.

"The total absence of any rocking motion, no pumps, or circulation of mercury.

"There is practically no loss of mercury.

"The cheap construction of the apparatus.

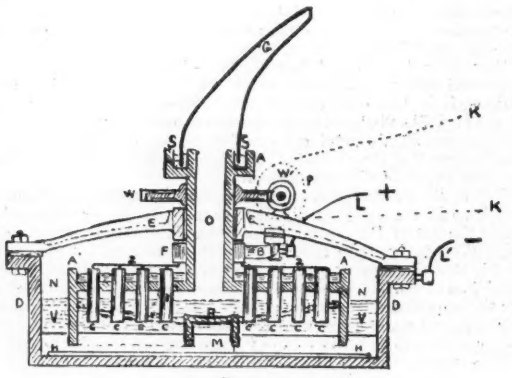
"The high efficiency obtained.

"The low potential necessary to effect decomposition.

"The ease of renewal of anodes, and the minimum destruction of same.

"The apparatus, in addition to its use for the extraction

of metals, soda, potash, and other alkaline salts, can also be successfully used for the electrolytic production of a large number of other chemicals, such as nitric acid, chloroform, naphthaline, nitro-benzol, aceto-acetic ether, &c."



Section.

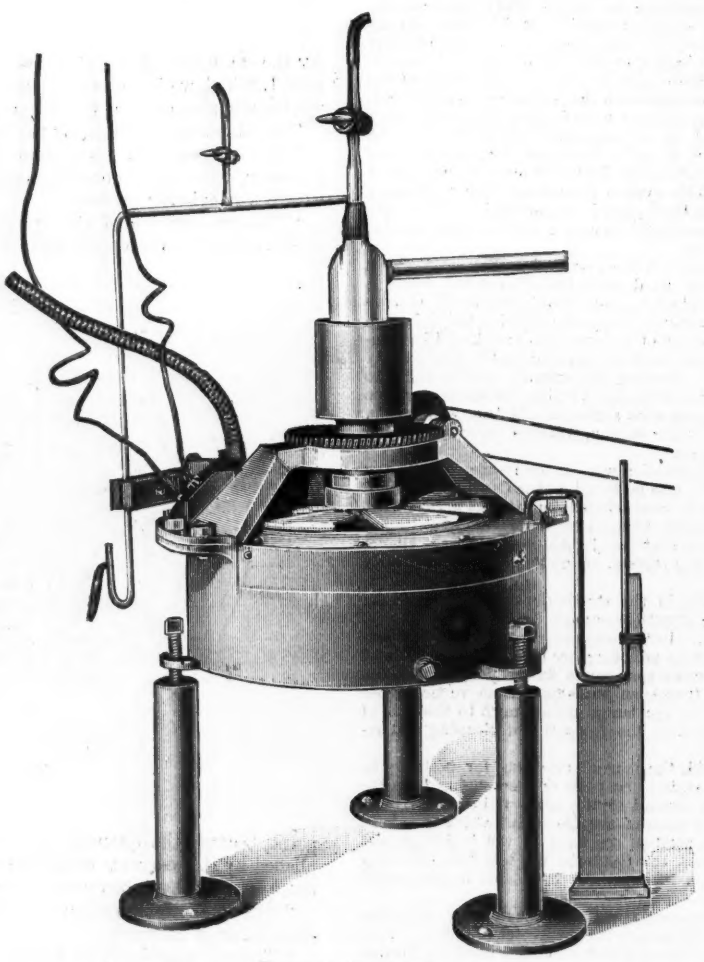
By Rhodin's apparatus it is held that the percentage of chlorine has been raised to 37 per cent., the highest quality produced by the old and expensive chemical process.

The apparatus was shown in operation at the demonstration on Tuesday, and though it was smaller than will be used in every day work it was sufficiently large to show the operation of the apparatus. The external view and the diagrams show the apparatus in detail.

The cell consists of an outside shallow dish or containing vessel, made of cast or wrought-iron, as seen at D D in the drawing. This drawing is diagramatic and is not intended to exhibit the method by which the brine and caustic solution is run into the vessel and drawn out of it. Inside this iron vessel, D D, there is another vessel made of pot or earthenware, which consists of an inverted portion, from the bottom of which a series of open tubes project, the edges of which pass down beneath a layer of mercury, M, which is placed in the bottom of the iron vessel, D D. In the top of this earthenware vessel there is a cylindrical opening or tube, O, which has at the top a water seal, S S. This cylindrical pipe is made to revolve on its centre axis, so that the whole of the inverted vessel is carried round the central axis of this pipe, which is kept in its place by a bridge, E, which spans the upper portion of the containing vessel, D D. The revolution of this vessel is accomplished by means of a wheel, W, which works into a worm, W', and which is driven by a belt, K K, from any suitable source of power. The top of this cylindrical vessel is divided into six or more compartments, each of which is perforated by a number of holes, through which carbon cylinders, C C C C C C C C, are inserted.

In large sized cells these triangular compartments may be made separate, and enclosed in an iron frame. The carbons are cemented in by a layer of cement, which fills the top of these triangular compartments level with the projecting rim at A. Immediately beneath the collar of the girder, E E, which carries the tube, O, there is a ring of metal, F, which is carried round when the vessel revolves. All the carbons are connected up to this ring, F, by suitable metallic leads, Z Z, which are in electrical connection with the carbon cylinders. A brush, B, slides on the ring, F, and connects the carbons by a lead, L, with a positive pole of the dynamo, or other source of electricity. The negative pole of the dynamo is connected to the outer containing vessel, D, by the lead, L.

The action of the cell is as follows. The layer of mercury, M, forms a lute or seal with the downward projecting edges of the inner earthenware vessel, A, so that when the inner vessel is filled with brine, R, and the outer annular space, N N, is filled with pure water, no connection between the liquid contents of these two portions of the cell can possibly take place.



Rhodin's Apparatus.

When the electric current passes through the cell the current passes from the lower end of the carbon cylinders to the surface of mercury, M. The chlorine is given off at the surface of the carbon poles, and is carried away through the central tube, O, and the hood, G, to the bleaching powder chambers. The sodium amalgam forms on the surface of the mercury in the inner portion of the vessel at the bottom surface of the brine, and passes, partly by diffusion and partly by the mechanical agitation of the mercury occasioned by the revolution of the inner vessel, to the outer annular space, N N, where the layer of water, V V, extracts the sodium in the form of caustic soda.

The mechanical agitation is assisted by placing radiating vanes in the bottom of the containing vessel, which are represented in the diagram at H H, and these conduct the mercury to the outer edge of the vessel.

In actual working the iron containing vessel, D D, is heated externally to such a temperature that the liquid contents of the cell are raised to a little short of boiling

point, and this is claimed to not only prevent the absorption of a large amount of chlorine in the brine, but also to increase the efficiency of the water in taking out the caustic from the amalgam and reducing the electrical resistance of the liquid film between the lower surface of the carbon cylinders and the surface of mercury.

The efficiency of the cell is claimed under suitable conditions to exceed 95 per cent. of the theoretical ampere hour output. There can be no denying the ease with which the cells can be examined, and the parts renewed if necessary, and the simplicity of action is most marked.

There is practically no loss of mercury, and as it is entirely under the surface of the liqnids, and never requires to be disturbed, and the hydrogen is given off on the inner surface of the iron containing vessel, there is no mercury vapour found to be injurious to the workpeople. It is said by the inventor that as the caustic only comes in contact with iron which is insoluble in it, the caustic liquor is perfectly pure, and can be raised in density up to, commercially, 30 per cent. before it is drawn off, and this saves a large amount of fuel necessary for further concentrating it.

The flattering remarks made by various experts on the Rhodin's apparatus leads one to expect some startling results. We shall watch the commercial development of the process with considerable interest. No actual figures were given at the demonstration to show the productive powers of the apparatus, but no doubt these will be forthcoming.

THE THUNDERBOLT GOVERNOR.

We have recently had brought before us a most ingenious system of governing, which seems to merit the most careful attention of all those concerned in the nice regulation of engines, no matter for what purpose they may be used.

The governors are divided into three classes. One is for controlling any kind of marine engine so that it will run smoothly and at any desired speed, to which it may be adjusted at pleasure, whilst the engines are running, no

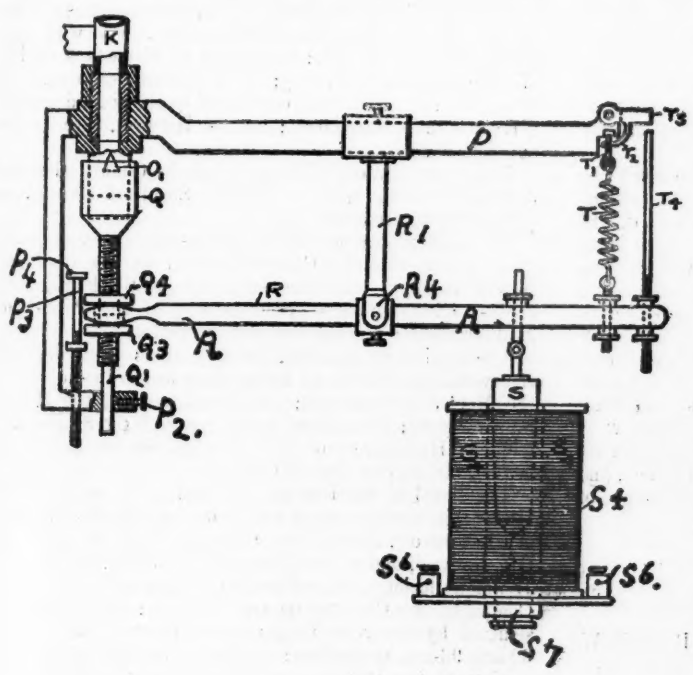


Fig. 1.

matter whether in head sea, following sea, or beam sea, or whether the vessel is floating light or is heavily loaded; the patent regulator of speed provides convenient adjustment to meet all contingencies, and to prevent racing by anticipating it in head seas; also, should the propeller or engine shaft break whilst in action at any time, our emergency gear will act automatically and stop the engines.

Another is for controlling any desired adjusted uniform

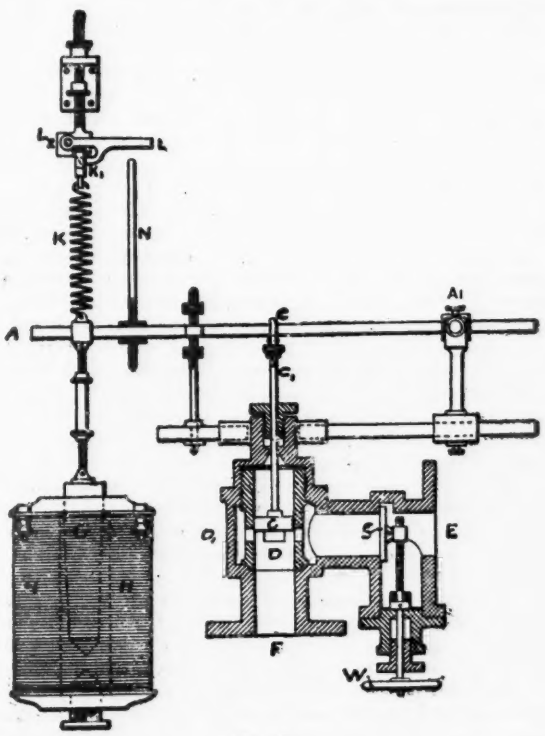


Fig. 2.

speed of any kind of stationary and electric engines or turbines, notwithstanding variation of loads, and for stopping the engine when an accident occurs.

The third being for controlling electrically the speed of engines and electric power supply motors, so as to automatically compel the engine or motor to increase speed when increase of load is switched on, and to decrease the speed when the current is switched off any part of the circuit, thus preventing excessive and damaging current pressure on the circuits and plant, likewise saving fuel, wear, tear, and labour.

The first type is an air-compressing governor, in which air pressure is utilised to operate the throttle valve. An increased speed of engine causes an increase of air pressure in a duplex air-compressing pump, which has the effect of compressing a spring in a governing cylinder, and thereby closes the steam throttle valve of the engine by means of a lever connection; when the air pressure is reduced the spring in the governing cylinder forces down the piston and opens the throttle valve fully, or partly. This type of governor is mainly employed for marine engines, and as there is nothing electrical about it, there is no necessity to describe it in detail.

When the air-compressing governor is to be employed to control the engine or motor of an electric power or lighting plant, the pressure controlling device, illustrated in fig. 1, is employed and is connected with the governor. The air pumps which receive their motion from the engine, the speed of which is to be regulated, will take in a supply of air and discharge same into the pipe or passage, K, thence to the governing cylinder. The amount of escape of air through the port, o^1, and consequent pressure of the air upon the piston is controlled by the increase or decrease of the

amount of load or number of lights in the system; for instance, if a number of lights in the circuit be suddenly switched on, a decrease of current will pass through the solenoid coil, S^4, and consequently less attractive force will be exerted on the core, S, thus allowing the spring, T, to act to arise one end of the lever so as to lower the valve, Q, and open the port, O^1. An increased escape of air thus takes place through the port, O^1, and consequently a reduced pressure is exerted upon the throttling piston, which will then move forward, owing to the pressure of the spring, which encircles a rod, thus actuating the said rod to open the throttle of the engine or motor and cause an increase of speed of the engine which will be communicated to the dynamos. With a switching off of lights the reverse action takes place.

If the current be suddenly cut off from the circuit, owing to breakage of belting or circuit, or any other cause, the safety appliance, shown in fig. 1, will come into operation, so as to prevent the racing away of the engine. In such case the pull of the core, S, is relaxed, and the spring, T, causes one end of the lever, R, to jump up, and with it the rod T^4, which then strikes arm T^3 and releases the hook T^2 from the frame T^1, thus causing that end of the lever, R, to drop by the force of gravity and so close the port, O^1. The air-pressure on the piston is thereby increased and forces the piston and rod back, completely shutting the throttle valve so as to stop the engine.

The third type is an automatic adjustable electric governor for controlling the speed of engines and other electric motors, directly or indirectly by electric motive power.

The *modus operandi* of this invention is described as follows:—

Assume the appliance to be connected up with the inlet pipe, E, fig. 2, connected to the steam boiler or other source of motive fluid to the pipe, F, supplying the dynamo engines. If the apparatus be at work and an additional number of lights be switched on the circuit it will immediately cause a decreased current to pass through the coil, H, and consequently a less attractive force will be exerted on the core, G, thus allowing the spring, K, to act to raise such core partially out of the coil. This action will raise one end of the lever A, which fulcrumed at A^1 and with it the piston rod C^1 and piston C thus opening the ports D^1 in the cylinder D, and allowing an inrush of steam or other motive fluid into the engine cylinder through the pipe, F. The speed of the engine will thereby be increased, so communicating to the dynamo an increased speed of electrical supply to maintain a greater number of lights on the circuit.

On shutting off a number of lights a reverse action will take place, that is the core, G, will be drawn down, and with it the lever, A, so lowering the piston, C, and proportionately closing the ports, D^1.

If the current be suddenly cut off from the circuit the safety appliance will come into operation, so as to prevent the racing away of the engine. The pull of the core, G, will then be relaxed, and the spring, K, will cause same to jump up, and with it the rod, N, secured to the lever, A, so causing said rod, N, to strike the pin, L, and to turn it on its fulcrum, L^2, thereby releasing its opposite end from engagement with the slotted frame, K^1, which, now released, drops, and with it the end of lever, A, thus causing the piston, C, and rod, C^1, connected to the lever, to close the ports, D^1, and thus stop the further supply of fluid to the engine. S is a sliding stop valve for shutting off steam by turning the wheel, W.

The Thunderbolt system of governing is being used on one of the engines of the Liverpool Overhead Railway, and is giving great satisfaction; it is moreover highly spoken of by Lord Kelvin and other prominent engineers.

REVIEWS.

First Principles of Electricity and Magnetism. By C. H. W. Biggs. Published by Biggs & Co., London. Price 3s. 6d.

We regret the insertion of the notice of this book which appeared on pp. 531—2 of our issue, October 22nd, 1897; and desire to unreservedly withdraw that notice, feeling after a further examination of the book that the conclusions of the reviewer are not warranted by the extracts and references given. We trust our readers will consider the review in question as unwritten.

Traité Complet d'Electro-Traction. Par Ernest Gerard. P. Weisstenbruch, Bruxelles.

This is a book of 624 pages, illustrated with 567 woodcuts, by far the most important work on electro-traction hitherto published. The author is engineer-in-chief in the traction and construction department of the Belgian State Railways, and Chef du Cabinet of the Belgian Minister of Railways, Posts and Telegraphs. The work is essentially practical and, to use the author's expression, documentary, giving the substance of specifications and records obtained in visits of inspection to installations and trials which the position of the author rendered obligatory. It is in fact a technical and commercial exposition of the applications of electricity to locomotion, setting forth the various successive steps in the progress realised in this direction since the first practical attempts in 1879.

Commencing with the electric motor and the means of regulating its action, the author describes the original Siemens motors, those of the Sprague and Thomson-Houston types, and those worked by accumulators on the Birmingham tramway and elsewhere. Passing to the motors with single reduction gearing, of trans-Atlantic introduction, the so-called Edison motor of 1891 is described and illustrated. A considerable amount of space and illustration is given to the Thomson-Houston motors of the types S.R.G., W.P. 30, G.E. 800 (it being explained that the numbers refer to the pull in pound at the rim of 32-inch wheel), and to those of 50 to 100 H.P., all produced after the Thomson-Houston Company had merged into the General Electric Company, of New York. The tetrapolar Westinghouse motor, with removable elements connected to convey the current to two brushes only, on the Mordey principle, and the new series of motors produced by the same firm next receive consideration, as well as the truck motor, said to be due to the Baldwin and Westinghouse Companies. The single reduction "Short" motor is favourably mentioned, and details are given of the Oerlikon motors, and of the 16-H.P. motor of the Allegemeine Elektricitäts Gesellschaft. The motors of Elwell-Parker type, produced by the Electric Construction Company, of Wolverhampton and London, dispensing with any enclosing armour, and the tramway motor of the Liège International Company are next described and illustrated. The list of simple single-reduction motors is completed by the motor of the General Société de l'Industrie Electrique, somewhat after the Thomson-Houston type, but with some interesting modifications; the motors of Siemens & Halske; of the Lyons firm of Averly; of the Walker Company, Cleveland, Ohio; of Schuckert, constructed by the Société anonyme d'Electricité de Nuremberg; and of Hillairet, with a single-coil field magnet.

Under the section "Transmissions by Conical Gearing," Johnson-Lundell, Sperry, Detroit Electrical Works, and Sylvey motors are described.

A section is also devoted to chain-gearing motors, under which is described the Galle chain used on the Bessbrook-Newry Railway, and that employed at Blackpool. The chain-gearing motors of Siemens and of the Paris-Lyon-Mediterranean Company here receive notice.

The section on transmission by endless screw illustrates the system introduced by Reckenzaun in the London and in the Marseilles tram cars; the Pendleton and the Holroyd Smith motors; the endless screw motor of the Société Electricité et Hydraulique of Charleroi; and the locomotive used in the Marles mine (Pas de Calais).

The so-called gearless motors receive full consideration. Under this heading come the Short and the Westinghouse gearless motors, those of the City and South London Electric Railway, and of the Liverpool Elevated Railway, the Heilmann locomotive, and that experimentally tested by the Compagnie des Chemins de fer du Nord; the motors constructed by the New York General Electric Company for 30 and 96-ton locomotives; the motor for the experimental carriage of the Belgian Government, and the Immish gearless motor for launches.

Lastly, a section is devoted to triphase motors, first applied for purposes of locomotion by M. Heilmann. A motor of this type is in use on the Lugano tramway; it is of 20 H.P., and was constructed by Messrs. Brown, Boveri & Co.

(To be continued.)

CORRESPONDENCE.

Municipal Wiring.

Some months ago (I believe, in November last), you had an article in your paper on "Municipal Wiring," referring to the matter of corporations undertaking private installation work, and citing the towns of Leicester and Stafford as instances where this was the practice, you remarked: "If the local electrical engineers only knew how, they could easily stop this unfair competition." About this time I made several complaints through the Press of the Leicester Corporation competing against the local electricians, the result being that the Electric Light Committee decided not to allow their officials to canvass for orders, but the department might undertake private installations, should they be asked to do so. Thinking this decision would remove the unfair competition, I made no more to do in the matter, but experience has taught me that the promises of the electric light committee of the Leicester Corporation are not to be depended upon, the officials having canvassed, if not so openly, just as keenly as before. Now this state of things has, I think you will agree, gone a little too far, when I tell you the Corporation are not satisfied with getting orders for installations to be connected to their mains, but have actually carried out contracts for complete installations which are some distance from their mains, and which will never require current from them.

As the electrical undertaking in Leicester has proved most disappointing to the members of the profession, as well as the ratepayers, the former being subjected to an unhealthy competition and the latter having to pay for an unprofitable concern, I am anxious to know how I could prevent the Corporation from competing against the ratepayers with their own money. Trusting to be favoured with the necessary information.

Civis.

Your correspondent raises a point that has more than one side. It is really a legal question, and the glorious uncertainty of the law renders it a difficult and risky thing to dogmatically offer an opinion, but with due modesty the following remarks may be tendered.

If the Corporation is making a loss on wiring the rates will suffer, in which case it is very probable that a refusal to pay together with the reason—as aforesaid—or the offer of a portion of the amount demanded would have effect, particularly if simultaneously similar steps were taken by all the wiring contractors in the town.

A second procedure is to apply for a mandamus to restrain the Corporation from engaging upon work for which they do not possess legal, statutory, or Parliamentary powers. The only question is how far certain rather non-specific sections of the Electric Lighting Acts and Provisional Order might be relied upon to excuse, even if they did not authorise such work.

Lastly, if I were affected in such a way I should at once write to the Board of Trade on the subject pointing out that the Corporation was exceeding its powers and engaging upon private work of an electrical character, and asking their intervention. What the answer would be remains to be seen, but there can be no doubt that Corporations indulge in this unfair class of competition on sufferance and on no other ground.

I note that your correspondent raises two other points (*a*) that complete installations are carried out, and (*b*) that canvassing is undertaken by the Corporation staff. Now, the following questions must be met by the Corporation:—(1) How was the capital, by which wiring is done, raised? (2) How are the salaries of canvassers paid? (3) Is any charge connected with wiring included in the statutory yearly accounts of the Electric Lighting Department?

The auditors of the Corporation accounts and the Local Government Board cannot pass items for which no statutory powers exist. Therefore, as regards (1) and (2), it appears likely that effective action might be taken at the annual audit by lodging objections to the accounts and charges and questioning their accuracy. If (3) can be proved then the Board of Trade are morally certain to move in the matter.

Briefly, the Board of Trade and the Local Government Board have ample powers to surcharge any amount which the Corporation may have disbursed without proper powers. It is evident from your correspondent's remarks that grave abuses are tolerated and capital provided for some proper purpose is being used for an unauthorised purpose. Your remarks, therefore, that "if the local electrical engineers only knew how, they could easily stop this unfair competition," are quite to the point.

The Writer of the Article.

Sterilisation of Impure Water by Ozone.

The public are much indebted to Mr. Andreoli for his very able article on the "Sterilisation of Impure Water by Ozone," which appeared in your issue of 15th inst.

The subject, which is of particular interest at the present time, when general attention is called to the prevalence of typhoid fever at Maidstone and Lynn, has been so fully treated of in the article referred to from a bacteriological aspect, that no further remark is necessary; but in the interest of humanity and science some further information might be given as to the means of supplying the necessary ozone or ozonised air, and its expense. The general public would also be better able to understand the subject if the yield of ozone by any particular apparatus was worked out in British measures of contact or weight, than by referring to the product as "grammes of ozone per horse-power-hour."

Mr. Andreoli would confer a great benefit if he will mention the methods by which, as he states, ozone can now be produced in large quantities and in a continuous manner.

It is known that an apparatus has been successfully working continuously for many months, which supplies air highly charged with ozone, at an expenditure of two amperes of electric current in a quantity of 2,000 cubic feet per hour at a cost of 1d. for electricity. This generator is now coming into commercial use. The system for the purification of water recently investigated by the Belgian Government, and reported to have their support, uses ozonised air, and the cost of the ozonisation of the water at the Brussels Exhibition is stated to be ½ centime per cubic metre, or about 35 cubic feet.

It is assumed that Mr. Andreoli refers to ozonised air, not to ozone produced from oxygen, so that it will be interesting to your readers, and specially to those who are investigating this important subject of water purification, if he would work out the cubic contents of 100 grammes of ozonised air, the cost of which he estimates to be 1d.

As regards the mechanical means necessary for the application of ozonised air to the impure water, an apparatus is now in constant use, which causes a most intimate mixture of ozonised air with a fluid of far more viscosity than water and which no doubt could be easily adapted for sterilising purposes.

W. J. Engledue,
Colonel, late Royal Engineers.

October 23rd, 1897.

Wireless Telegraphy.

The term elevated electrodes, in connection with wireless telegraphy, is not a happy one. It does not convey a clear idea of the apparatus used for long distance.

Mr. Marconi attaches a vertical wire to one of the terminals of his instrument at each station, the other being put to earth. The wire is surmounted by a metal shape, to give additional capacity.

Experiment seems to show that slightly better results are obtained with the capacity than without it. However that may be, there is no doubt whatever that the vertical wire is the essential feature.

Prof. Minchin claims priority on this point because he used a horizontal "collecting" wire, several feet long, attached to his receiver only; but if the apparatus were arranged as he describes in the letters in your issue of October 15th and 22nd, it was practically a "conducting" wire.

To obtain good results, the wire must be *vertical*, as may

be seen from the following extracts from notes on actual experiments:—

1. Vertical wires, 100 feet in height, earthed at transmitter and receiver. Distance signalled 4 miles.
2. Same wire placed horizontally—150 yards.
3. Vertical wire 100 feet at transmitter, and copper strips at receiver—30 yards.
4. Same wire fixed at receiver and transmitter, fitted with spherical electrodes only—40 yards.
5. Vertical wire 50 feet, at both stations gave 3 miles.
6. Same wires placed horizontally—about 50 yards.
7. Vertical wires 50 feet, at both stations earthed at transmitter only—1,100 yards.
8. Same wires earthed at receiver only—2 miles.
9. Copper strips substituted at both ends—30 yards.
10. A horizontal wire, 350 feet long, was erected 12 feet from the ground at each station. The transmitter was placed one mile from the receiver. No signals were observed, even with the most sensitive Coherer.

The horizontal portion of the wire was then cut off leaving a 12-inch vertical wire at each instrument, perfect signals were received on a much less sensitive tube.

It may be stated for the information of Prof. Minchin, that the mathematical theory, that the distances signalled varies with the square of the height of the vertical wires, has been verified beyond a doubt by actual experiment.

Trial seems to indicate that the section of the vertical wire is unimportant, which is also in accordance with theory.

Adverse criticism has gone so far as to doubt Mr. Preece's statement, that signals were sent and received, although an intervening hill obscured the two stations.

The fact that impulses can be imparted to a receiver placed in a sealed iron case, is almost universally denied. Mr. Marconi will, at an early date, show that this is possible.

It will be interesting then to note how many of the sceptics following their present tactics will lay claim to having done the very same thing long ago.

J. N. C. Kennedy,
Capt., R.E.

Engines for Electric Traction.

I regret to have to call your attention to a serious danger which at the present time threatens our young English electrical engineers, due to the extensive circulation in this country of an American publication devoted to street railway interests.

If the writers in that journal were content to enumerate the miles of tramline, of which the cars are driven by electric transmission of power in the various cities of the Union, and other triumphs of the electrical engineer, no harm would be done, but when they descend or ascend to the production of educational articles on "Engines for Electric Railway Power Stations," the danger is exactly proportional to the amount of faith which the fine printing and beautiful pictures of the said journal may excite in the minds of its readers.

We are now entering upon an epoch of great activity in electric traction, during which some millions of pounds sterling will be expended on steam and electrical machinery; after the first year or two, the spending of the greater part of this money will devolve upon our indigenous engineers, and the breadth of their intelligence and education will determine whether capital will be economically employed, or whether it will be recklessly squandered as it has been in the United States.

England is a rich country, but it is not rich enough to afford waste of any kind, least of all waste of engineering labour and material at a time when the total productive power of the country cannot keep pace with the demand.

The writer of the above-mentioned article on "Engines for Electric Railway Power Stations," is Charles E. Emery, Ph.D.

No direct evidence is apparent as to the grounds on which the worthy author was created a Doctor of Philosophy, but there is abundant circumstantial reason for believing that his versatility in the use of the American language must have weighed well with his examiners. In the course of the article he succeeds in working up the verb "to operate" to a grand total of 57 times.

This, however, is merely average American journalese, but when the Dr. has fairly warmed to his work, he grinds out some of the finest flours of emery composition that are to be found in contemporary literature.

For instance, here is a gem:—

"The side thrust on the engine frame is at the level of the center of the cylinder. It may be resisted where the bedplate or legs of the engine frame join the foundation, if that be immovable, but it is comparatively narrow and frequently rests on earth, which is slightly flexible, instead of rock, so that the lateral force, relatively small though it be, operating at a height of 8 to 12 feet above the foundation, does rock the foundation and the engine upon it slightly in a lateral direction, or at least give them a perceptible lateral jar as full pressure steam is taken at the beginning of a stroke."

After reading the above paragraph your young friends will feel like the Queen of Sheba, there will be "no more spirit in them," for under no circumstances can they hope to beat it.

When, however, the worthy Doctor descends to the consideration of mechanical problems his genius leaves him and he contents himself with reproducing the commonplace American fallacies, the leading and most serious one being that an engine for traction purposes must be specially strong in its working parts, "its entire construction must be proportioned to stand the racking due to the continued repetition of shocks."

This oft-repeated fallacy would be amusing were it not for the fact that it is too often believed, and, worse still, acted upon; whilst all the time the fact remains that there are no shocks and no excessive strains.

Every automatic expansion engine takes practically the full boiler pressure at every stroke, whether the load be light or heavy, and in every stroke the total pressure commences at maximum and falls to minimum, consequently in the normal working of such an engine under constant load, the changes in the rate at which power is being generated per inch of travel of piston varies from maximum to minimum, say from two to six times per second; that is to say, the variations are far more rapid than can possibly be produced by changes of external load.

But suppose an excessive load be suddenly thrown on the dynamo and the engine be called upon to give off its maximum power, does not that strain it? Certainly it increases the torsion on the crankshaft and the wear on the bearings for a minute or two up to, but not exceeding, the amounts of the similar effects in electric lighting engines, which are usually worked steadily at full power. Take the Willans engine, which is lightly built, it is quite common practice to have several of these engines at work for hours every day, with the stop valve fixed wide open, developing their absolutely maximum power; and moreover doing it with complete satisfaction to everybody. Now if one of these engines were put on to a traction load all the variations would obviously be reductions of power, and consequently the torsion on the shaft and the wear on the bearings would be less with the varying load than with the maximum load.

I regret to have to trespass on your valuable space simply to kill a dead dog, but this particular dog has a habit of getting up and wagging his tail after each successive killing, nothing less than cremation will ever settle him.

After all that has been said, correctly or incorrectly, about strains and shocks, there remains a very serious possible trouble which may, and often does, arise out of a sudden variation of load—this is the formation of water in the cylinders and receiver when the load is suddenly increased.

The first effect of an increase of load is to cause the governor to raise the mean pressure and with it the mean temperature of the steam passing through the engine. This steam striking against surfaces at a lower temperature partially condensed and throws down water to an extent which, in long stroke engines, may be serious. The strains caused by even small quantities of water in the cylinder are very violent and often destructive, therefore an engine to be suitable for traction purposes should have good drainage and sufficient clearance. Corliss and slide valves give the greatest safety, whereas piston valves give no natural relief to the water, which can only get out through the spring valves. Steam jackets applied to the cylinders and receiver provide an absolute cure.

From one point of view, Dr. Emery's article is excellent.

It gives a good bird's-eye view of American practice in horizontal engines, and the pictures are admirable. His next article, which is promised for January, 1898, will be awaited with interest.

John S. Raworth.

October 26th, 1897.

Dynamo Design.

What a boon it would be to students if writers of dynamo design could be prevailed upon to use same letters to denote the same quantities! Mr. Fry calls N number of windings; now N is generally used for the magnetism of a machine, and S to represent turns on a field coil. Again, why use μ for a constant when some other letter not having a special significance attached to it would do as well. If I read the symbols aright, the equation

$$N_2 = \frac{N_1 C_1 - N C_n}{C} \text{ means}$$

$$\text{series turns (to counteract armature reaction)} = \frac{\text{total amp. turns on magnet coils} - \text{amp. turns on shunt}}{\text{amperes in external circuit}}$$

but subtraction of above quantities gives amp. turns on series, and dividing by C, the actual series turns which include allowance for fall of potential due to armature resistance at full load as well as number of turns required only for armature reaction. Does the formula $N_1 C_1 = \sqrt{N^2 C_n^2 + N_a^2 C_a^2}$ admit of application to any type of dynamo toothed or plane armature?

N. C. Wood, Jun.

P.S.—Could you oblige me with any information regarding platino silver wire ·0025 diam., as used in Cardew voltmeters, as to weight, price, &c.

Dust Destructors.

Your correspondent, "Practical Experience," when writing recently to the Electrical Review in reference to the dust destructor at Shoreditch, makes a great mistake, and one that is no doubt being made by many of those connected with different vestries in the Kingdom, who are anxiously watching definite results, when he supposes that the dust collected at Shoreditch is composed for the most part of house cinders and cabbage leaves. Those acquainted with Shoreditch, with its large warehouses, furniture factories and shops, know that the bulk, at any rate, of this so-called dust is principally composed of parts of packing cases, wood, shavings, cardboard boxes, and the like, not bad fuel under any circumstances. I venture to say that those vestries who have decided to adopt dust destructors on the strength of the success obtained at Shoreditch, and who have nothing better to consume than house cinders and cabbage leaves, will find themselves in possession of a white elephant, and one that will require a lot of feeding.

J. Beresford Bolton.

THE ENGINEERS' STRIKE.

A third of the year being now spent in idleness, the Board of Trade has intervened in the struggle by a proposal for a conference. The suggestion seems to be, in the first place, after the manner of an order—As you were! This accomplished, and work going on, the conference is to discuss and settle the hours of labour. The employers are to disavow any intention of smashing the Union—a thing they have disavowed all along and which has been raised by the executive officers of the A.S.E. purely as a war cry to bring in funds, while on the other hand the men are to declare they do not wish to interfere with shop management. It all seems very one sided. One side is to refrain from doing what it has never attempted to do, the other side is to refrain from what it has been doing for years until it has become second nature. For the men to cease interfering means that they are to cease obeying their leaders' orders to limit the output of machines or harass non-union men. The following is the rough draft of the Board of Trade proposals:—

"1. The Employers' Federation, while disavowing any intention of interfering with the legitimate action of Trades Unions, will admit no right of interference with the management of their business. The Trades Unions on their part, while maintaining their right of combination, disavow any intention of interfering with the management of the business of the employers.

2. The demand for a forty-eight hours' week made by the Joint Committee on the Federated Employers in London without previous request for a Conference with the employers is withdrawn.

3. A Conference between representatives of the Employers' Federation and the Engineering Unions concerned in the dispute shall be held forthwith, to discuss and settle the hours of labour.

4. The constitution of the Conference shall be arranged between the chairmen or other selected representatives of the parties."

We have heard men declare that the A.S.E. have not restricted output. Bearing on this, however, it is reported from Sheffield that at some of the large works the output of machine tools is now very different from what it has been under trades union rules. Large planing machines are doing 40 to 50 per cent. more work; drills and slotters are doing 25 per cent. more and one man is attending two machines. There is far too general a consensus of opinion as well as the evidence of many American critics upon shop output for any manner of doubt to remain as to the restrictions in output which union men have long carried out.

It is not a little strange that the daily press appear to have a very meagre comprehension of the real facts of the struggle. The *Standard*, for example, writes as though there had only to be a conference in order to decide upon the working hours in the engineering trade and all would be well. It is as though the *Standard* would call upon a shopkeeper to agree to a conference to decide if he should sell his goods at less than cost price. The engineering employer cannot, under existing conditions, afford the eight hours' day. We say existing conditions, for this covers a lot. We know from absolute experience that it is difficult to get men who will work a full week at a stretch. They lose quarters, and half days, and even whole days, and two days at a stretch. While men are thus absent machinery is idle, and this is an existing condition which makes eight hours impossible all round. Lost time on Monday through Sunday excesses is an existing condition, and another condition is incompetence. The respectable steady, competent workman is paying to support those who prefer idleness, who never intend to do other than scamp their work, and are howling for eight hours so as to have leisure to improve their minds. If Trades Unionism is going to be smashed, as the leaders thereof seem to think probable, the smashing will come from within. Signs of a rupture are in sight. Many of the better men have withdrawn from the A.S.E., they are disgusted at the admission of the duffer who, not able to do the work yet drew the same pay. A late member of the A.S.E. writes to the *Standard* and girds at the harsh tyranny of the A.S.E. and its cruel enforcement of idleness. The vast body of the men have no knowledge of what 'tis all about. They had no voice in starting the strike, and themselves acknowledge they are absolutely in the hands of a ring of non-workers who have become their all powerful masters and executive. It can scarcely be thought that, if the A.S.E. has anything of the Phœnix in its composition, it will not be run on very different lines. There is a pretence at taking a poll of the victims—we mean members—before a strike is ordered. The pretence is an exceedingly hollow one. No real poll is taken. A decision to strike is made on a small vote, not in any way canvassed, and representing the younger and noisy faction. No strike ought to be possible until the votes of every member have been obtained, and every member not voting ought to be subject to a fine. When a vote has been taken and a strike decided on by a majority of at least two-thirds of the votes, every man having one vote for each year of membership, the fact should be made known to every member that a second vote will be taken in, say, three weeks' time to fix the matter. Again, every member *must* record his vote, and this second poll *must* show an increase in the majority, or the strike must be postponed or dropped. Such a plan of action would give men a pause before taking a fatal step. They would have time to weigh up matters and clear their judgments. The general secretary ought to have a general control of the society's business, but absolutely no handling of money, and during a strike he should be placed on half-pay. A few curbs like this on hare-brained madness and incapacity would prevent a lot of mischief, and put a stop to much levying on the unfortunate working man. However, to revert to the question of existing conditions, we say that under existing conditions the eight hours' day is not practicable, but given a set of workmen all sober and intelligent, capable of understanding the economic conditions as to machine production, and with a determination to tear the life out of a machine tool and to be well paid for doing so, then where is the employer who would not be glad to yield on the question of hours? But the men do not approach the employers in this spirit. On the contrary, instead of allowing machinery to do the drudgery, they refuse to allow it to do this. Those who know what a lathe will do and what it is allowed to do will best perceive our meaning. The Union ask for short hours, but they show no grounds for their demands. The employer has had to stand by for some years and witness a steady falling off of production from his machinery and an equally steady rise of wages. With the improved machinery he may have put in he had a right to expect an increase in production, and he could scarce have refused a share of that production to the worker. But the worker has worked from orders emanating from Stamford Street; he has dozed over his work and slowed down speeds and taken light cuts, and then he has asked for more pay and shorter hours. The employers are looked upon simply as men to be plundered. No

sympathy is given to them, and there is not even given a thought to the probability that a workshop may be closed when its working involves a loss or even a too heavy load of worry. In the meantime the papers are full of correspondence, much of which we should like to reprint if space allowed. One in the *Engineer* signed "Apprentice" is an illustration of the ignorant views held on the question of machine attendance. "Apprentice" argues that men capable of attending to machines must not be permitted to do so if they are labourers because this would reduce wages. It is a well known fact that labourers who are satisfactory as machine men receive higher wages for this than when they are labourers. How, then, can such a practice possibly bring about what "Apprentice" claims it will, viz., "less money in circulation." If the labourer be not permitted to attend such common work which ought to be below the notice of the skilled trained mechanic, there will be so much more work to be done in Germany or America, for, as we have already shown, the cost of labour in England is now prohibitive on a large range of work. The refusal to allow the labourer to earn a better wage simply means less work for smiths, ironfounders, and pattern makers, carters, and railways, clerks, and draughtsmen, and less building of new shops, a reduced trade in timber, electrical plant, and tools. Thus for one skilled man displaced by a labourer, there are scores of fractions of men of all kinds shut out of work in England amounting in the aggregate to many men. This cannot be drummed into the Trade Unions. They cannot see it, and though their leaders may see it, these leaders' principles do not run in a direction to make them tell the plain honest truth. "Apprentice" must be very narrow minded. He is also very inconsistent, for he says very truly that one trade affects another when he is arguing about reduced wages, yet he cannot see the all round good effect of keeping trade in the country which cannot be done here except by employing labourers and not fitters and machine men to do labourers work. "Apprentice" displays, in fact, the narrow views of the protectionist. The protectionist, as we all know, can never see an inch beyond the man immediately protected; he has no eye to or thought of the great public. So, the trades union protectionist, who wants to compel the employment of a skilled workman to feed straight bar iron into an automatic machine, has no thought to the dozen other trades who would lose by the process.

Up to going to press nothing had been decided by either side as to agreeing to the conference. The *status quo ante* is of course impossible to secure. When men have gone out on strike the result has been two-fold. First the work now to be done is in many cases less because orders have fallen off; in the second place many fresh men have been engaged, and clearly these cannot be discharged, and we regret to say there are workshops in which numbers of old men have been kept on but who will be dispensed with, and must come upon the A.S.E. superannuation fund—if that fund still exists? Employers have been treated as not human and everything done to ruin them. Such men cannot be made both to lose money and be sentimental at the same time.

It is a curious commentary on the fondness of men for a strike, that while they will strike at once if their executive order it, they are unwilling to go back to their work by order. The boiler makers who went out without an order refused to return, though it is believed they soon must, as they forfeit strike pay by striking without leave.

The *Times* of Friday last has a well considered leader on the question and urges the employers to agree to a conference which does not imply any power to arbitrate. On the other hand the men are urged to take a dispassionate view of the question and seriously warned against impertinent interference of Germany and America. *Danaos dona ferentes* is aptly quoted in alluding to the help from these two countries, the artisans of which could very well afford to find funds for years to maintain the strife.

At the close of a meeting of the Executive Council of the Amalgamated Society last week, Mr. Barnes made the following statement: "At present we cannot make any authoritative statement respecting the proposals of the Board of Trade, but the Amalgamated Society of Engineers are ready to meet the masters *in conference as we always have been*"!!! Has Mr. Barnes any memory, or does he wilfully make such glaring misstatements? In August last he issued a report, to which we have before referred, and this report contains the following passage: "Conciliation or arbitration, mediation or conferencing, upon the question cannot be entertained."

In the meantime the A.S.E. continues to receive some material support from the two countries named, and also from France, and a great weight of moral support also as a proof of solidarity. If these foreign workers really wished to show proof of solidarity, we should think they would go and do likewise, but they continue to work their 10, 11 and 12 hours per day, while howling to the Englishman to strike for eight. It is very funny, but the humour is lost on the A.S.E.

BUSINESS NOTICES, &c.

Bankruptcy Proceedings.—According to official notice in the *London Gazette*, a petition by Messrs. W. T. Henley's Telegraph Works Company, Limited, for making a receiving order against Mr. S. Bousfield Tatham, of 26, Thurloe Place, South Kensington, electrical engineer, will be heard in the Bankruptcy Court on November 4th, at 12 o'clock noon.

Book Received.—*Light: Visible and Invisible.* By Silvanus P. Thompson. A series of Royal Institution lectures, Christmas, 1896. Published by Macmillan & Co., Limited. Price, 6s.

Electrical Wares Exported.

Week Ending Oct. 26th, 1896	£	s.	Week Ending Oct. 26th, 1897.	£	s.
Amsterdam	100	0	Alexandria. Teleph. mat.	17	0
Antwerp. Elec. fuses...	50	0	Amsterdam	107	0
Bombay. Elec. fuses ...	12	0	Antwerp	85	0
"	18	0	Barcelona. Teleg. mat....	10	0
Brisbane	65	0	Brisbane. Telep. mat. ...	129	0
Buenos Ayres	300	0	Brussels. Telep. mat. ...	80	0
" Teleg. mat.	80	0	Calcutta	114	0
Calcutta	220	0	Canterbury	28	0
Cape Town	376	0	Clinde	13	0
" Teleg. mat.	144	0	Cologne. Teleg. mat. ...	1,572	0
Colombo	21	0	Colombo	438	0
" Teleg. wire ...	120	0	Copenhagen	127	0
Demerara	10	0	Durban	670	0
Durban	118	0	East London	53	0
East London	130	0	Fremantle	66	0
La Treport	18	0	Gibraltar	8	0
Lisbon	14	0	Halifax. Teleg. cable.	20,500	0
Melbourne	250	0	Hiogo	25	0
" Teleg. mat. ...	84	0	Lisbon	50	0
Monte Video	33	0	Madras	30	0
Para. Teleg. cable ...	3,650	0	Malaga	160	0
Port Elizabeth	381	0	Melbourne	66	0
Riga	17	0	" Teleg. mat. ..	1,364	0
Rosario	945	0	Ostend	60	0
St. Petersburg. Teleg. material	420	0	Santos	476	0
Spezzia	140	0	St. Petersburg. Teleg. cable	216	0
Sydney	389	0	Shanghai	298	0
" Teleg. mat. ...	150	0	Singapore. Telep. mat.	21	0
Teneriffe	10	0	Stockholm. Teleg. wire	39	0
Wellington	570	0	Sydney	255	0
			" Teleg. cable ...	33	0
			Wellington	454	0
			" Teleg. mat. ...	623	0
			Yokohama	10	0
Total	£3,822	0	Total	£28,197	0

Foreign Goods Transhipped.

Rangoon. Telep. mat....	164	0

Catalogue.—An excellent catalogue has been issued by the Consolidated Telephone Construction and Maintenance Company, Limited. The front cover is very neatly arranged, the "C.T.C., 1897," standing out in bold relief in gilt lettering on a chocolate paper cover. The general arrangement of the catalogue does great credit to Mr. Menzies, in whose hands, we understand, the compilation has been. He has made it a labour of love, and the company's customers will find it of considerable service to them, hence it will not be a case of "love's labour lost." The prices in the book are, we understand, as low as the British workman will allow them to be. To attempt to even mention all the apparatus and accessories described in this catalogue is more than our space will allow. There are receivers, transmitters, magneto bells, generators, exploders, magneto and battery bombination telephones for wall and desk use, telephones and telephone switches for special uses, lightning arresters, wires and cables, insulators, and everything required in connection with telephone construction.

Mr. James Dickson, of Gray's Inn Road, W.C., sends us a list of the "Tieciton" dynamo brush, with a number of testimonials.

Dissolution of Partnership.—Messrs. G. H. Kendall, J. Sunderland & R. Gee, carrying on business at Frith Street, Huddersfield, as mechanical engineers, have dissolved partnership by mutual consent. Messrs. G. H. Kendall & R. Gee will continue the business under the old style and attend to debts.

Winding-up Petition.—A petition presented by Messrs. J. & R. Shorrock, Limited, of Bolton Road Foundry, Darwen, for the winding up of the Direct Automatic Stoker Syndicate, Limited, will be heard at St. George's Hall, Liverpool, on November 1st, at 10.30 a.m.

Liquidation Proceedings.—A general meeting of the Max Saturn Electrical Syndicate is to be held at the offices of Messrs. Manlove, Alliott & Co., 57, Gracechurch Street, E.C., on Wednesday, November 24th, at 2 o'clock, for the purpose of receiving an account of the winding-up operations from the liquidator, Mr. W. S. Mackenzie.

A general meeting of the Blackpool Electro-Hydropathic, Limited, will be held at 36, Victoria Street, Blackpool, on Wednesday, November 24th, at 4 o'clock p.m., to hear an account of the winding-up operations by the liquidator, Mr. Richard Bowman.

A general meeting of the Universal Electric Carriage Syndicate will be held at the London Tavern, Fenchurch Street, E.C., on December 2nd, at 2 o'clock, to receive a report by the liquidator (Mr. W. O. Attree) of the winding-up operations.

Electrical Engineering in France.—A correspondent says:—"The Société L'Eclairage Electrique, of Paris, has recently brought out a special form of dynamo for use in connection with the manufacture of calcium carbide. The machines are of the Labour type, and are arranged horizontally, that is, with the shaft vertical, numerous advantages being claimed for the arrangement adopted. Already the company has supplied a number of dynamos of this type, including an installation of 1,000 H.P. at the works at Grenoble of the Société Internationale du Carborundum.

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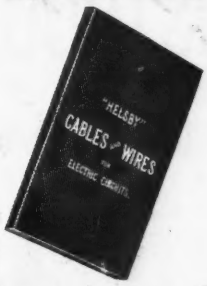

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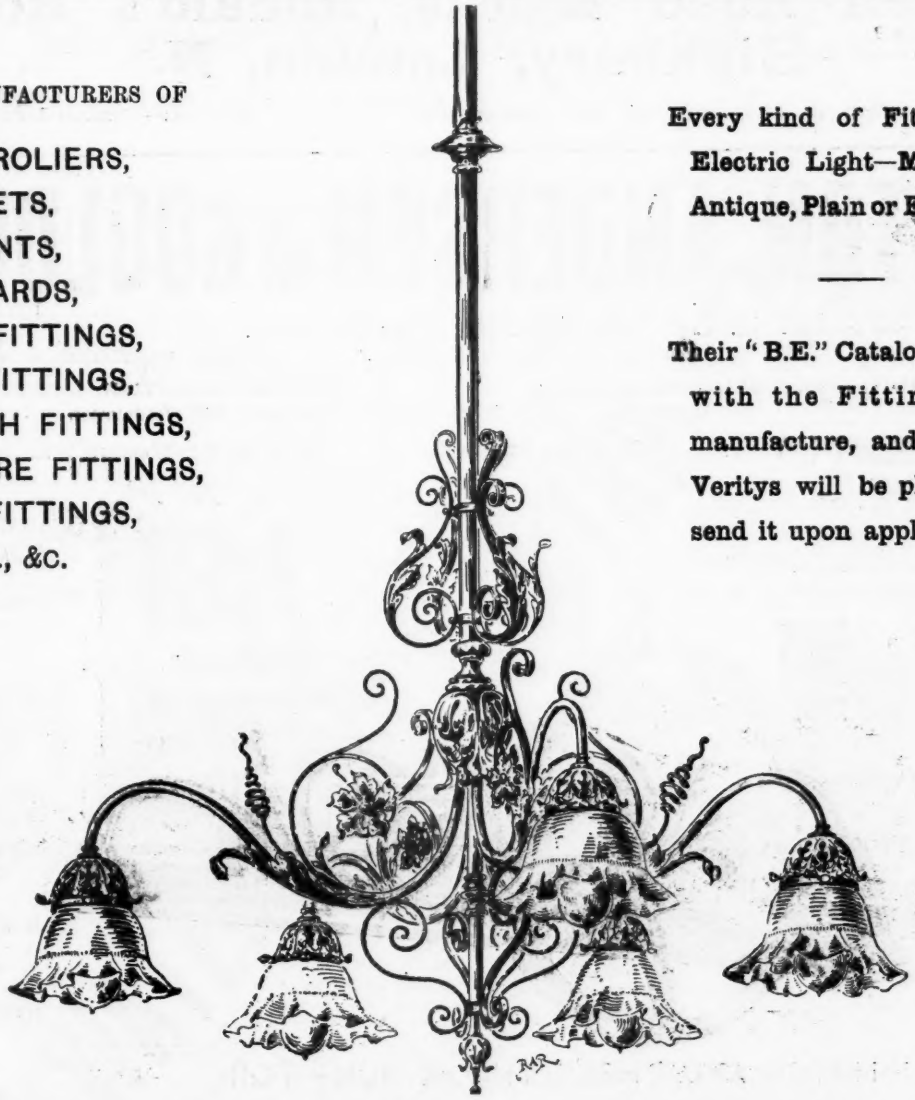

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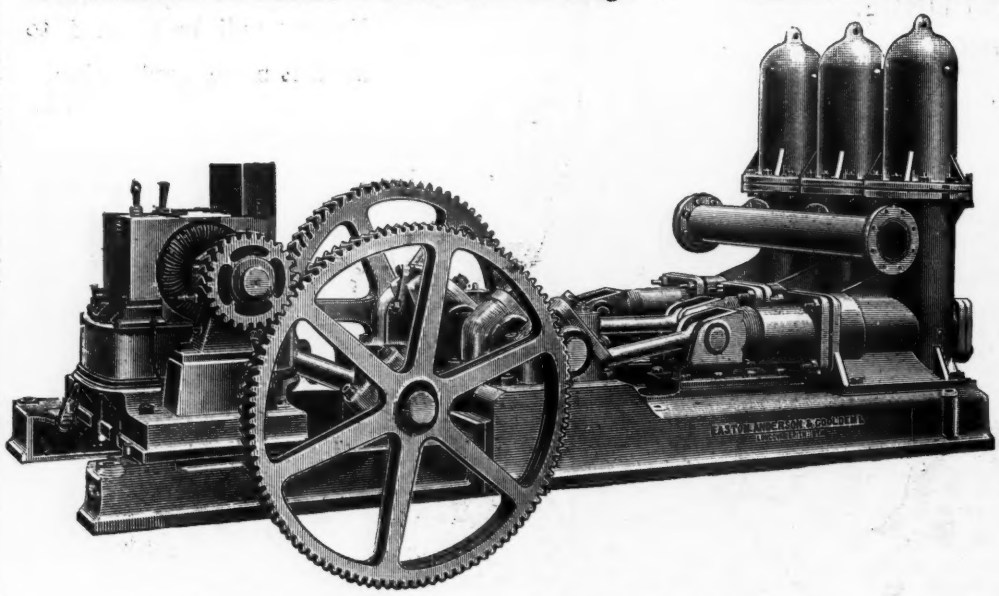

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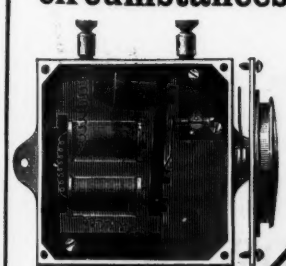

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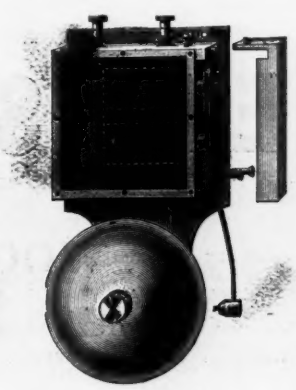

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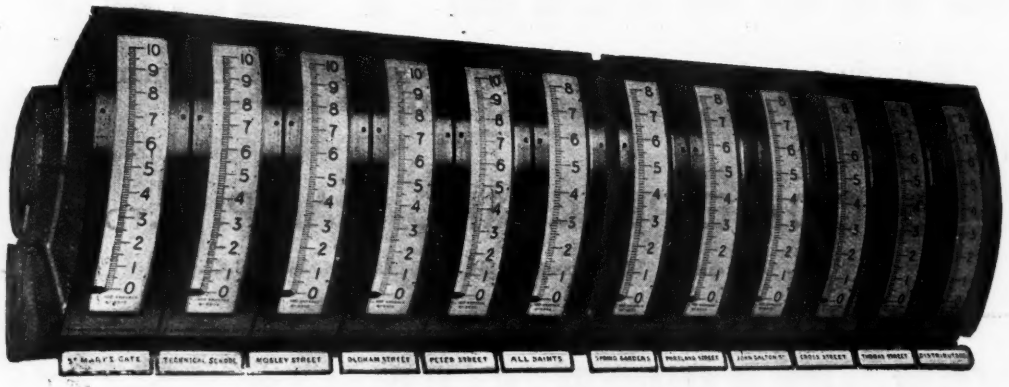

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Official Notices.

CORPORATION OF AYR.

ELECTRIC LIGHTING.—FREE WIRING.

TENDERS are invited from firms willing to undertake the Free Wiring of Premises in the Streets of the Burgh. For full particulars as to districts in which the mains are laid, apply to ARTHUR J. FULLER, Burgh Electrical Engineer.

Tenders, with full description of the scheme, and terms, must reach me not later than THURSDAY, NOVEMBER 11th, 1897. The Council do not bind themselves to accept any offer.

A. G. YOUNG,
Town Clerk.

1797

BLACKPOOL CORPORATION ELECTRIC TRAMWAYS.

THE CORPORATION OF BLACKPOOL are prepared to receive Tenders for the following works required in the conversion of their present system of electric traction.

Section A.—Steel Columns, Brackets, and Straining Posts.
„ B.—Trolleys, Trolley Wire and Insulators.
„ C.—Controllers, Motors and Gearing.
„ D.—Mains and Section Fuses.

Tenders will be received for one or more sections, but not for part of a section.

Specifications, general conditions, and form of tender, may be had upon application to the undersigned on prepayment of the sum of Two Guineas, which will be returned on receipt of a *bonâ fide* tender upon the prescribed form and within the time stated. Drawings and plan of route may be inspected at the office of the undersigned during the usual office hours.

Sealed tenders, addressed to the Chairman of the Electric Lighting and Tramways Committee, and endorsed "Tender for Traction Material, Section ....." to be delivered to the undersigned not later than 10 a.m. on MONDAY, NOVEMBER 22nd, 1897.

The Corporation do not bind themselves to accept the lowest or any tender.

ROBERT C. QUIN,
Borough Electrical & Tramway Engineer.

Corporation Electricity Works,
Blackpool, *October 27th*, 1897.

1796

Official Notices.

BOROUGH OF SHOREDITCH.

CONTRACT No. 10.

THE SHOREDITCH VESTRY invite tenders for the supply and erection of additional engines and high-tension continuous current generators, with an extension of the existing Switchboard.

Specifications and forms of tender can be obtained on and after OCTOBER 8th, 1897, at the Offices of the Engineers, Messrs. KINCAID, WALLER & MANVILLE, 29, Great George Street, Westminster, on payment of a fee of £5 5s., which sum will be returned on the receipt of a *bonâ fide* tender.

The Vestry do not bind themselves to accept the lowest or any tender, and the contractor whose tender is accepted shall enter into a formal agreement, under seal, with sufficient sureties for the due fulfilment of his contract.

Trade union rates of wages and hours to be observed.

Sealed tenders endorsed "Electricity Supply, Tender for Contract No. 10," to be sent at or before noon on TUESDAY, NOVEMBER 2nd, 1897, to

H. MANSFIELD ROBINSON,
Vestry Clerk and Solicitor.

Town Hall,
Old Street, E.C.

1798

VESTRY OF ST. PANCRAS.

THE VESTRY OF ST. PANCRAS are prepared to receive Tenders for supplying and fixing additional plant at the Regent's Park Electricity Works, comprising dynamos, engines, and switchboard.

Copies of specification, conditions of contract, and form of tender to be obtained upon application to the CHIEF CLERK, Electricity Department Offices, No. 57, Pratt Street, N.W., on payment of a deposit of £1, which will be returnable on receipt of a *bonâ fide* tender and specification.

Tenders to be sent to the undersigned endorsed "Tender for Engines and Dynamos, &c," by 12 o'clock noon on Tuesday, November 2nd, 1897.

The Vestry do not bind themselves to accept the lowest or any tender.

C. H. F. BARRETT,
Vestry Clerk.

Vestry Hall, Pancras Road,
London, N.W., *October 11th*, 1897.

1745

[*Continued on next Page*]

Official Notices.—*Continued.*

COUNTY BOROUGH OF BURNLEY.

TENDERS FOR ELECTRIC LIGHTING CABLES.

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Sealed tenders, endorsed "Tenders for Cables," and addressed to the Chairman of the Electric Lighting Sub-Committee, Town Hall, Burnley, must be delivered on or before WEDNESDAY, NOVEMBER 17th, 1897.

By Order,
WM. T. FULLALOVE,
Town Clerk.

Town Hall, Burnley,
October 16th, 1897.

1787

GLASGOW CORPORATION.

ELECTRICITY DEPARTMENT.

TO ELECTRICAL ENGINEERS.

THE GLASGOW CORPORATION invite applications for the position of Chief Resident Engineer of their Electricity Department. Applicants, besides possessing practical experience in all matters relating to electricity, must be specially qualified to prepare designs and specifications for, and to carry out the construction of generating stations and the laying down of mains and all other works necessary for the production and distribution of current for lighting and motive power, and to take the entire general management of the department. The salary will not be less than £800 per annum, but the successful candidate will require to devote his whole time to the duties of the office.

Applications, stating age and experience, accompanied by 20 printed copies of not more than six testimonials of recent date, to be lodged with the Subscriber, marked "Electrical Engineer," on or before 9TH NOVEMBER NEXT.

Canvassing any member of the Corporation will disqualify applicants.

J. D. MARWICK,
Town Clerk.

City Chambers, Glasgow,
October 21st, 1897.

1788

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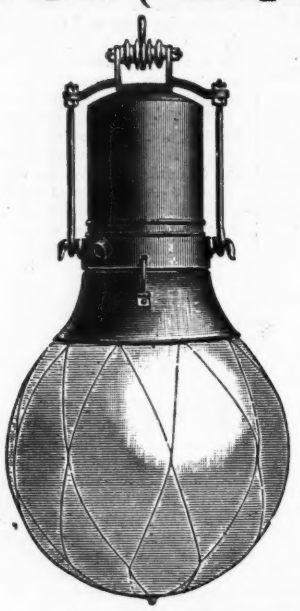

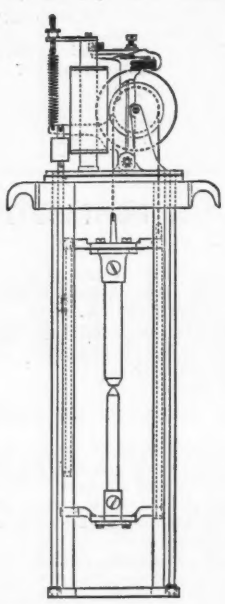

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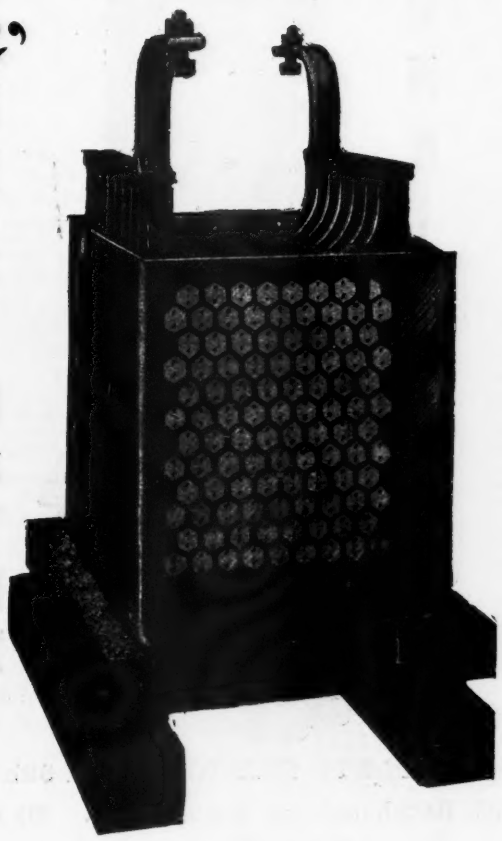

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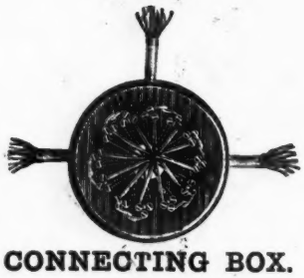

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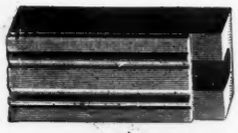

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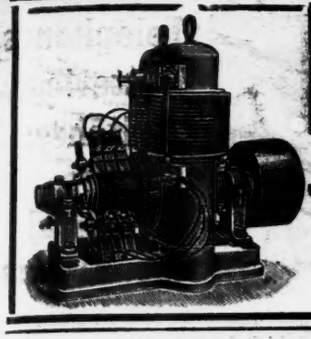

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AGENTS.—Old-established manufacturing firm of everything electrical, requires a live Agent in every important town in England. Business men having extensive connection will be treated with on liberal terms.—1,756, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1756

CIVIL SERVICE COMMISSION.—Forthcoming examination. Clerk in the Operative Department of the Royal Mint (20—25) November 9th. Technical training and qualifications necessary. The date specified is the latest at which applications can be received. They must be made on forms to be obtained, with particulars, from the SECRETARY, Civil Service Commission, London, S.W. 1793

GOOD WIREMAN wanted for light, own casing.—WARD BROS., 13, Beer Lane. 1818

IMPROVERS.—The Gilbert Arc Lamp Co., Ltd., Chingford, Essex, have room for Improvers or Pupils from a technical college. Must give time in lieu of premium. Apply afternoon. 1816

WANTED.—Good Draughtsman for designing dynamos and motors. Must be thoroughly practical man. State references, wages, &c.—Address 1,792, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1792

WANTED.—Electric Light Wireman, one used to bell and telephone work preferred.—Apply, with particulars, to MASON, WATHES & BROWN, Rutland Street, Leicester. 1794

WANTED.—Cable Hand, used to overhead pole work, erecting, jointing, &c.—Apply 1,799, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1799

WANTED as Improver in testing room, a young man thoroughly conversant with arc lamp testing.—State age, salary, and experience, to the BRUSH ELECTRICAL ENGINEERING CO., LTD., Falcon Works, Loughborough. 1802

WANTED.—First-class Armature Winder as leading hand, must be accustomed to all classes of armatures.—Address THE CLAYTON FOUNDRY CO., LTD., Clayton, Manchester. 1819

WANTED.—As man in charge of a large central station, a competent Engineer-Fitter. Must have had experience in steam pipe and valve work, as well as general knowledge of engines and dynamo machinery. Age not exceeding 30.—Apply, stating salary required, and previous experience, to 1,813, ELECTRICAL REVIEW, 4, Ludgate Hill, London 1813

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A.I.E.E., 8 years' experience dynamo design and construction, estimating, installation work, business experience, seeks re-engagement.—1,779, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1779

ASSISTANT WIREMAN seeks situation, 6d. hour.—"D. W. B.," 1, Old Kent Road, S.E. 1815

ASSISTANT WIREMAN wants job; 3 years' experience. 6d. hour.—"A. B.," ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1800

ELECTRICAL ENGINEER (age 22), having taste for drawing, desires appointment as Assistant Draughtsman in London. Three years' workshop; now in charge of 532 lights installation. Certificates electric-lighting and elementary machine drawing. Small salary to commence.—1,803, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1803

ELECTRICAL ENGINEER seeks situation in central station, or charge of private plant. Central station experience with Willans engines; also experience with various gas engines.—"ENGINEER," 254, King Street, Hammersmith. 1808

ELECTRICAL ENGINEER (24) seeks responsible berth; used to installation erection; testing. — 1,809, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1809

ELECTRICAL ENGINEER (20) requires engagement as Assistant Draughtsman; four years' general experience — "X. Y.," ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1801

ELECTRICIAN requires berth as an Assistant Engineer with view to Partnership in manufacturing and installation business.—Address, 1,795, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1795

ELECTRIC LIGHTING. — Young gentleman, well up in installation work, theoretically and practically, desires re-engagement; salary a secondary consideration. — 1,789, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1789

ELECTRICAL ENGINEER (28) recently in charge of branch, seeks similar berth. Good business man, and experienced installation work and estimating for same.—Apply 1,733, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1733

ELECTRICIAN, working, nine years' references, thorough knowledge of accumulators, wiring, fixing dynamos, &c., would join out-door staff with good firm, or take charge of large installation. — Address 1,724, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1724

ELECTRICAL ENGINEER, 10 years' shop, drawing office, and installation experience, at present in charge of large installation, seeks change; good references.—1,778, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1778

ELECTRICAL ENGINEER, Theoretical and 10 years' practical experience, seeks appointment at home or abroad (speaks Russian).—Apply, 1,759, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1759

ELECTRICAL ENGINEER (25) seeks Appointment as assistant works' manager; six years' experience dynamo design, installations.—1,777, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1777

[Continued on next page.]

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WANTED.—Situation as Assistant Engineer in electric light and power supply station.—1,814, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1834

YOUNG Electrical Engineer seeks appointment as Junior Assistant, two years' theoretical, three years with leading firm, one year's central station experience; energetic. Excellent testimonials.—1,764, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 1764

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WANTED, Electric Lamp Tops and Scrap Platinum.—EDEY AND CO., 29, Ludgate Hill, London. 1473

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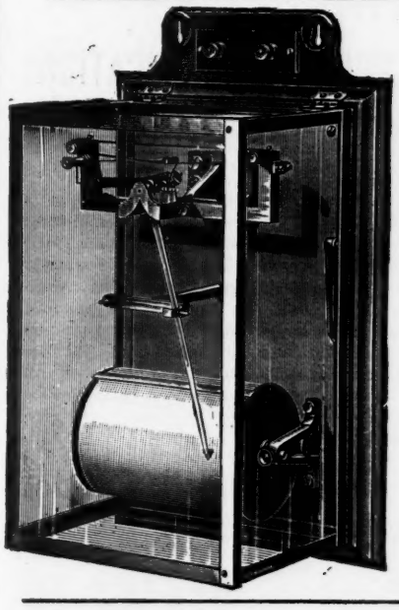

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II. Diphased Currents. Chapter 1. Generators. Chapter 2. Transformers. Chapter 3. Motors. Chapter 4. Multiple Transformers. Appendix A. Appendix B.

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NOTICE TO ADVERTISERS.

Advertisements for the Special Number should reach the Publishers not later than Monday, November 1st.

TWENTY-FIVE YEARS OF ELECTRICAL PROGRESS.

THE ELECTRICAL REVIEW.

Special Issue, November 12th, 1897.

THE ELECTRICAL REVIEW first saw the light of day on November 15th, 1872, as THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW, and it is proposed to celebrate the 25th anniversary of the REVIEW'S existence by issuing a Special Number on November 12th next. It is believed that this will be fittingly accomplished by inviting some of the leading men in the profession to contribute articles on their own particular subjects, in which to review and bring up-to-date the progress made in the various branches of Electrical Science.

The value and the interest which will attach to this special issue may be gathered from the subjoined list of subjects and writers, and others may yet be included.

TWENTY-FIVE YEARS' DEVELOPMENTS

IN

Alternate-Current Work	W. M. Mordey, M.I.E.E.
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Boiler Construction	W. H. Booth, M.Am.Soc.C.E.
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Magnetism	Professor Andrew Jamieson, F.R.S.E.
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Telegraphy—Military	R. Von Fischer-Treuenfeld, M.I.E.E.
Telegraphy—Overhead	W. H. Preece, F.R.S.
Telegraphy—Submarine	Chas. Bright, F.R.S.E.
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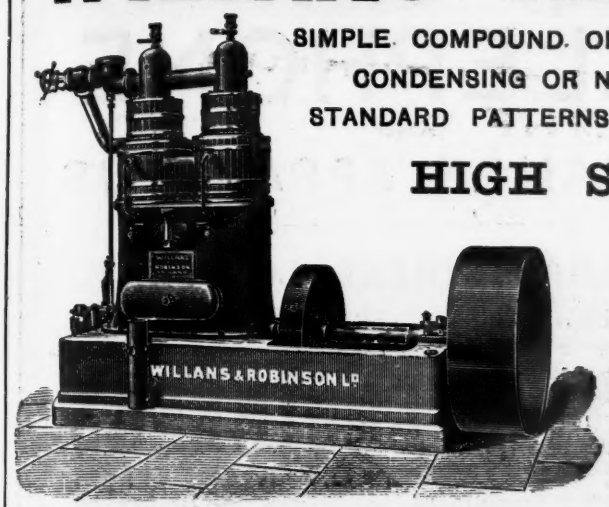

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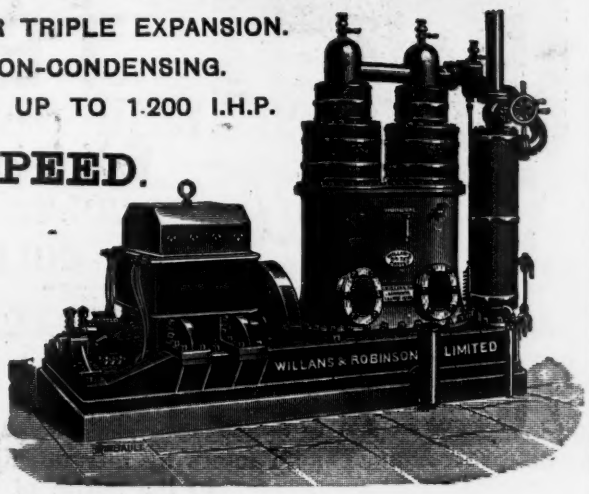

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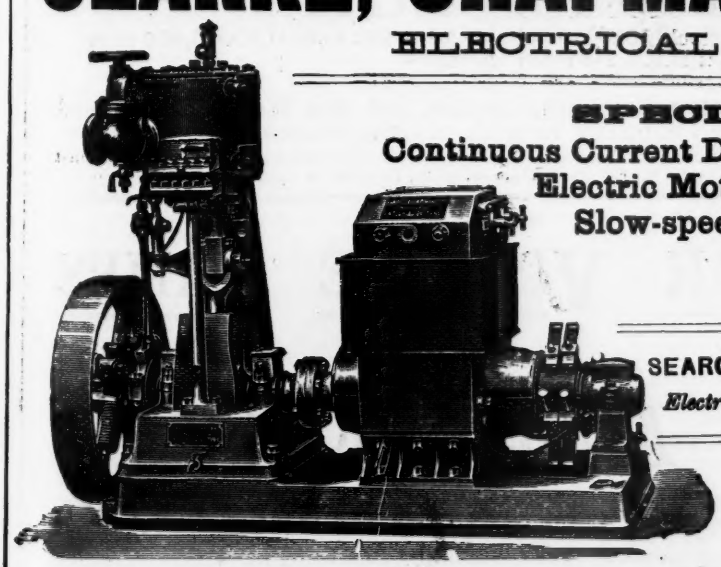

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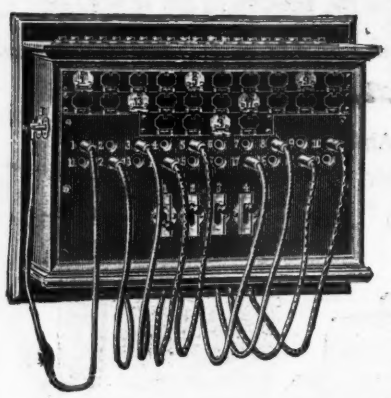

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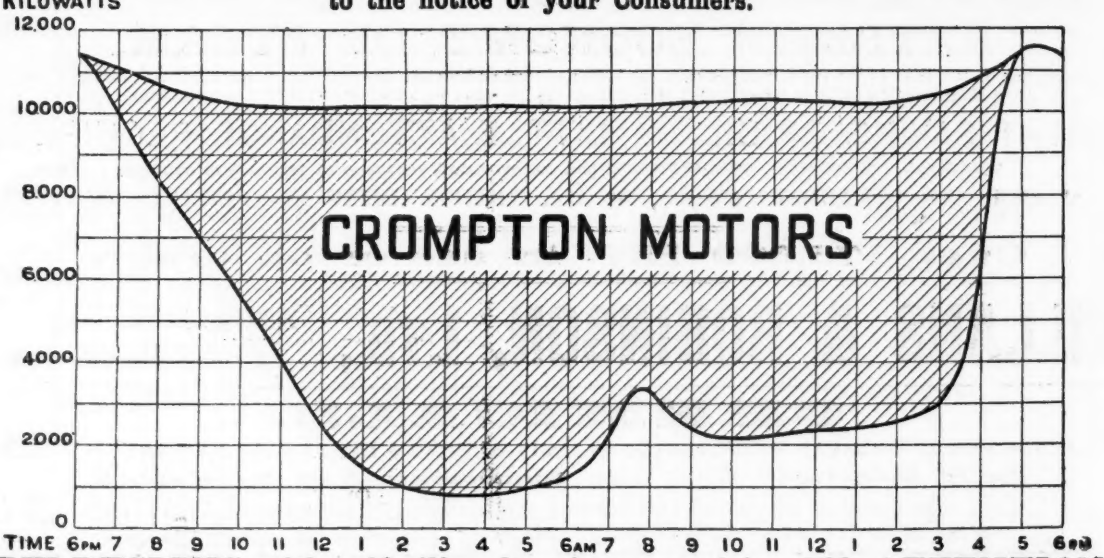

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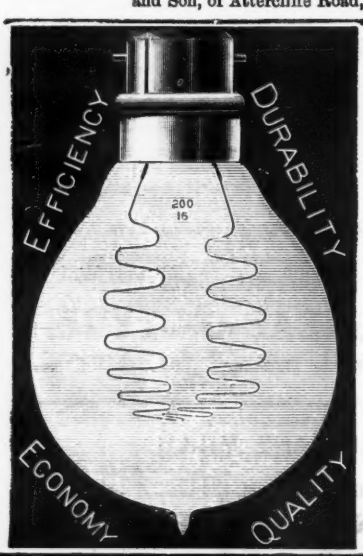

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Extension of Premises.—We are informed by Mr. G. Braulik, of 218, Upper Thames Street, that owing to the increased volume of business, he has found it necessary to rent two other large warehouses in the same vicinity, which has enabled him to open a show room in Upper Thames Street, and he invites inspection. We understand he keeps a very large up-to-date and well assorted stock for the prompt execution of orders. A speciality is incandescent lamps for ordinary and high voltage.

Fire Brigade Alarms.—The London County Council has given the contract for the maintenance of the electric bells belonging to the fire brigade to Messrs. Jackson & Coleby for three years, at £325 per annum. The present contract with Messrs. Jackson terminates on November 5th, and the new contract dates from that date for three years.

M.D. Arc Lamps.—An illustrated list giving prices and particulars of the M.D. patent arc lamps and accessories therefor, has been issued by Messrs. Moody Bros., of 68, Victoria Street, S.W.

Motor Cars.—A motor car service has been inaugurated between Hamilton and surrounding villages in Lanarkshire.

The "Rocket" Oil Engine.—Messrs. Robert Stephenson & Co., Limited, of Newcastle-on-Tyne, have issued a very neat little pocket list describing the "Rocket" oil engine. The various uses to which the engine may be put are generalised, and among the other items may be mentioned a report by Prof. Wm. Robinson, of Nottingham, of a trial of the engine made by him in July, 1895. There are a number of testimonials, including one from Major Sandford, showing the fitness of the Rocket engine for electric lighting at country mansions.

The Tudor Accumulator Company, Limited.—Mr. A. B. Pescatore informs us that, owing to the considerable increase in capital required by the rapid development of his business during the past year, he has converted his firm into a limited company, bearing the above name. All debts and liabilities of the firm are undertaken by the company, and all debts due to the firm are payable to the company. The conversion will not affect in any way the general conduct of the business, which will be carried on as heretofore. The staff remains as before, Mr. A. B. Pescatore being managing director of the new company. The offices will be transferred from Manchester to London in the early part of November.

Tickner v. Hofler.—This action, which came on for hearing at the Lord Mayor's Court, was a claim by Messrs. Tickner and Carpenter, electrical engineers, to recover the sum of £18 18s. 6d. for goods sold and delivered. The plaintiff's counsel, Mr. Moyses, said there was no dispute as to the order, the sole dispute being as to the price of certain of the goods delivered, and a counter claim was made by the defendant for £19 10s. The Common Sergeant said he should refer the case to the Registrar, who would go thoroughly into the accounts. A formal verdict was taken for the plaintiffs on the claim for £18 18s., and for the defendant on the counter-claim for £19 10s., subject to the decision of the Registrar.

ELECTRIC LIGHTING NOTES.

Aberdeen.—The Gas Committee has recommended an application to the Secretary of Scotland for a £10,000 electric lighting loan. The committee has had under consideration the question of providing a 600 H.P. engine for the electricity station, but has agreed to defer decision on the matter until the re-constitution of the committee after the municipal election. It was stated, however, that the matter will have to be dealt with on an early date, as it would take until autumn next year to build the engine.

Bath.—With further reference to the question of appointing a Clerk of Works in connection with the electric lighting extensions, we learn that notwithstanding the opinions expressed in council against such an appointment, the committee has engaged one at £2 10s. per week.

Belfast.—A summary drawn up by the Electric Committee of the electric light rental for the quarter ending September 30th, 1897, shows the progress of the electric light undertaking, even in the restricted quarters it now occupies, to be most satisfactory. The committee has been again obliged to decline applications for current, the station being overloaded as it is. The engineer has reported the results of his testing of 95 drums of cable, and the inspection of the construction of engines, dynamos, &c., on the contractor's premises.

Bolton.—At a meeting of the Town Council on Wednesday there was a discussion in regard to a proposal that the electric light undertaking of the Corporation should be governed by a separate committee, and not by the members of the Gas Committee as hitherto. The matter had previously been voted upon both at the General Purposes and Gas Committee meetings. In the case of the former the casting vote of the chairman was given against the division of the committee, and at the latter there were 17 members for the proposal and 20 against. On a vote being taken on Wednesday 30 were found to be in favour of the electric light undertaking being managed by a separate committee and 23 against. Several members of the Gas Committee voted for the division.

Bradford.—A Local Government Board inquiry was held on 26th inst. into the Council's application to borrow £50,000 for electric lighting extensions. Of this sum, £37,500 is for new mains and £4,000 for meters.

Brighton.—As the Lighting Committee are not at present able to estimate the profit on the electricity undertaking for the current year, the Town Clerk is not to include in the estimate for the next general district rate any sum to be paid over from the electricity account in aid of the general district fund.

Bristol.—At the meeting of the Electrical Committee last Friday, the cost of lighting the public lamps for the half-year ending March next was under consideration, and it was decided to apply for £2,429. It was resolved to carry out an extension of the mains from Guthrie Road to the Avenue at Clifton.

Burnley.—On the recommendation of the Electric Lighting Committee, the Council has approved plans of an extension to the electric lighting station. It is proposed to increase the engine capacity from 500 H.P. to 3,500.

Canterbury.—The Local Government Board has sanctioned the loan for the electric light plant and works.

Colwyn Bay.—The Council, owing to the steam roller being required for its legitimate use, have discontinued the temporary arc lighting of the new Promenade, and have decided upon a permanent installation. The temporary plant has been purchased by the proprietors of the Rhyl Pavilion, who are fixing it for lighting the outside of their premises.

We learn that the Council is to apply for a £1,300 loan for electric lighting, the details of the scheme to be arranged by the Highways Committee. The surveyor received offers from three firms *i.e.*, Messrs. Mather & Platt, £1,206; Crompton & Co., £1,361; Electric Construction Company, £1,092.

Coventry.—A substantial increase in the amount of electricity supplied from the Corporation works is reported for the quarter ending September 30th. The amount was 13,155 units as compared with 8,869 units for the corresponding quarter last year. The rental was £340 4s. 9d. as compared with £228 5s.

Dingwall.—The Town Council has adopted the electric lighting scheme proposed by Mr. Yorke. There will be 8 500-C.P. arc lamps and a number of 16 and 32 C.P. incandescents.

Dover.—The Dover Electricity Supply Company has given notice of its intention to lay mains, transformer boxes, &c., in certain stated thoroughfares.

Dublin.—A correspondent of the *Freeman's Journal* considers that before the electric lighting extension scheme is proceeded with, incandescent gas should be tried for the street lamps. With that suggestion we can find no fault, but the remarks with which he backs up his suggestion are really amusing. He says "It is obvious that an electrical expert's report will be more or less a prejudiced one," and "the opinion of a gas engineer" should be obtained. Then a gas engineer is not a prejudiced man and an electrical engineer is! This and further comment made by the correspondent lead us to believe that he himself is very much biassed in favour of gas, for he distorts facts by saying "In view of the failure of the electric light in so many towns (some having had to abandon it altogether), I venture to think that the suggestion is worth entertaining." We should like to know where are the so many towns where it has been a failure and the "some" where it has been abandoned. The "so many" towns where electric lighting has been a great success and given good profits to the municipality are of course not taken into account by a biassed gas advocate. We should have thought this letter beneath our notice were it not for the continued misstatements which are being made in the press wherever electric lighting is winning its way. When distortion of facts is resorted to it is a sign of acknowledged weakness on the side which adopts that line of opposition.

Edinburgh.—A main box explosion occurred in Gorgie Road on 21st inst. A little girl was injured by a piece of the cover.

With the view of preventing the recurrence of mishaps to the electric lighting system of the city, the Electric Lighting Committee has, according to the *Scotsman*, agreed to recommend that switches should be connected with the end of each feeder, and these would automatically open the circuit in case the feeder itself should in any way become damaged. The probable cost of the necessary supply of switches would be between £500 and £600.

Edmonton.—The District Council will consider in committee a letter which has been received from the Tottenham and Edmonton Gas Company on the subject of electric lighting.

Finchley.—The District Council has been considering the question of electric lighting, but has decided not to apply for a provisional order. There is another applicant in the field.

Glasgow.—The Corporation has decided that in any bill to be promoted by it in the next session of Parliament, application is to be made to increase the borrowing powers for the purposes of the Corporation Gas Acts and the Corporation Electric Lighting Order, 1890, by the sum of £1,000,000.

Mr. Maclay, the chairman of the committee on electricity, at a meeting on October 14th reported that, after considering as to how cases of abnormal demand in consumers' premises during the year should be dealt with in connection with the Brighton system of charging for current recently adopted by the Corporation, they had now to recommend that all consumers of current in private dwelling houses be permitted to have an abnormal demand 12 times in any six

months during the year without the same being registered by the meter used for indicating the maximum demand upon giving previous notice to the engineer of the time when such abnormal demand is to be taken, so that upon such occasions the demand indicator may be taken out of the circuit, and that the treasurer be instructed to notify this arrangement to all such consumers. The committee, having considered the foregoing report and recommendation, approved thereof. This minute has been adopted by the Corporation.

Gravesend.—The Secretary of the Great Western Electric Light and Power Company (Mr. Geo. Offor), writes a lengthy letter to the local press complaining that his company's application to the council for its approval to their proposed electric lighting scheme has not received proper consideration. He asserts that the Council settled the matter with another company before his people had time to reply to the Clerk's letter asking for more information. Mr. Offor states under seven heads the advantages which his company would offer to the district.

Greenock.—The Electric Lighting Committee finds that it can get expert assistance for its inquiries *re* electric lighting for £25, and it accordingly recommends that it be empowered to spend that sum.

Hackney.—The Public Health Committee and Electric Lighting Committee submitted at the meeting of this Vestry on Wednesday evening a joint report as follows:—(1). The Public Health Committee were considering the question of destroying the house refuse of the parish by means of a dust destructor; (2) They had been approached by several parties, each of whom was anxious to erect a destructor in connection with electric lighting; (3) Several meetings in conjunction with the Electric Lighting Committee had been held, and both Committees had fully considered the proposals of three of the principal parties in reference to the suggested transfer of the Hackney Electric Lighting Order, and begged further to report: *a*. In each scheme submitted, the destruction of dust was to be carried out at prices varying from 1/1 to 1/3 per ton. *b*. Each party was prepared to supply electric light at prices from 5d. per unit for private lighting. *c*. And to make terms with the Vestry for the repurchase of their undertaking. (4) The Committee therefore recommended that they be empowered to submit a proposal for the transfer of the Hackney Electric Lighting Order.

Hall Lighting.—It is proposed to light the Ladbroke Hall, Notting Hill, by electricity. The London County Council on Tuesday approved a plan showing the position of the lamps.

Hampstead.—The boilers at the electricity works are to be insured for £16,000, the premium being £18. A substation is to be erected at the corner of Birchington Road and High Road, Kilburn, at a cost of £219—£86 for the building and £133 for the transformer and other electrical apparatus. In consequence of non-delivery of the extension plant considerable inconvenience is being caused, and consumers are to be asked not to press the load between 6 and 8 p.m. on weekdays at present. It was stated at the last meeting of the Vestry that the contractor was ten months behind on his contract and the fines recoverable by the Vestry, if imposed, would be £800. The engineer is not to give his certificate for further payments to the contractors until the consent of the Vestry has been obtained.

Hornsey.—The District Council has had before it a recommendation from the Highways and Lighting Committee that steps be taken by the solicitor to apply for a provisional order, and that certain stated roads be the specified area. The proposal does not appear to have been carried. One member complained that nothing was stated as to cost—in fact, a scheme had not been considered at all.

Hove.—The Urban District Council intends promoting a provisional order for the supply of electricity in the parish of Aldrington.

Hull.—The borough electrical engineer who is now in receipt of £250 per annum, has asked for an increase of salary. Inquiries are to be made as to the salaries paid in other towns. A large number of fresh customers is being added lately, one being for 600 16-C.P. lamps.

Kingswinford.—The Rural District Council are to apply for a provisional order for electric lighting.

Leatherhead.—The *London Gazette* for 22nd inst. contains a notice of application which is being made by the Urban District Council for a provisional electric lighting order.

London.—The Notting Hill Electric Lighting Company is to extend its mains in Westbourne Grove.

Among various alterations being made at the Portman Chapel, is the installation of the electric light.

An electric main box explosion occurred in Ladbroke Grove, Notting Hill, on 25th inst.

Long Eaton.—The District Council has been asked to take into consideration the question of putting down an electric lighting plant for lighting the streets and supplying private parties.

Maidstone.—A company having given notice of its intention to apply for a provisional order, the Electric Lighting Committee is to consider whether the District Council should apply for an order.

Paddington.—The Vestry is to have six electric arc lamps placed in various thoroughfares by way of experiment.

Perth.—The Town Council on 21st inst., went into the electric lighting question. The Special Committee had advised by 6 votes to 2 that a provisional order be obtained, but the Council decided on the Provost's motion to call in Prof. Kennedy to advise them before the order be applied for.

Peterborough.—We understand that the Town Council last week decided to apply to the Local Government Board for a £15,000 loan for electric lighting scheme. The opposition to electric lighting has been long and severe at Peterborough, but in this town, as well as at York, such opposition has now been defeated.

Portsmouth.—A correspondent says: The new electric light station for Portsmouth Dockyard, which now comprises close upon 300 acres, will, it is estimated, cost £100,000. The new naval barracks are to be lighted by electricity, and eventually the system will be extended to Whale Island. A number of motors will be employed, supplied with power from the central station, and the whole of the driving in the dockyard will be carried out by electricity.

Rangoon, Burmah.—In our October 15th issue, under this heading, we referred to the proposed appointment of an electrical expert by the municipality. We now learn that Mr. Robert Hammond has accepted the appointment as consulting engineer to make a preliminary report upon the scheme. As soon as this report is submitted, the municipality will at once proceed with the establishment of the necessary works. We understand that for the past year the municipality of Rangoon (Burmah) have had under consideration the report of their engineer, Mr. J. Stirrat, upon the advisability of undertaking the supply of electricity within the city, and the present appointment is the result.

Rothesay.—The Town Council has decided to apply for a provisional electric lighting order, and a special committee has been appointed to make all the necessary arrangements.

Shoreditch.—The Vestry last week considered the finances of the electric lighting and destructor undertaking. The Finance Committee reported that they had considered the condition of the capital accounts of the undertaking. Mr. Adams stated that the present overdraft on the capital accounts amounted to £3,786 19s. 2d., and he suggested the advisability of considering future requirements so that a loan could be negotiated, and the expenditure definitely allocated. Over £10,000 had been spent out of monies borrowed for other purposes. The Vestry decided to ask the London County Council to sanction a loan of £15,000 on the lighting and destructor undertaking, and to lend the money for the longest term and at the lowest interest obtainable. The report was adopted. It was further resolved that future allocations of expenditure between the capital and revenue expenditure be determined by the Finance Committee, in the presence of the Lighting Committee chairman and the chief electrical engineer.

Skipton.—Dr. Hopkinson is to be consulted by the District Council as to his charges for advising on the question of electric lighting.

Southampton.—The Electric Lighting Committee has commenced the extension works.

Stirling.—The question of employing an architect for planning the proposed electricity station was before the Police Commission last week, Prof. Kennedy having written to know whether he should engage his own architect. The Commission, however, in going into the matter did not seem to know what to do in regard to the scheme, for statements were made by several members] to the effect that it was not likely to be profitable. In the end the matter was referred back to the Lighting Committee "to look into the financial aspect of the question as well as the practical part of it."

Torquay. — We understand that the selection of an electrical engineer for the Corporation station has been referred to Prof. Ayrton. We recently commented on the manner in which the Council considered the matter. It is stated that Prof. Ayrton has been selected by the president of the Institution of Electrical Engineers, to whom the Council applied for advice.

Watford.—The Council have declined to entertain the offer of an electricity supply company to take over the provisional order. The Council will borrow £21,000 for the purpose of carrying out the scheme themselves. The consulting engineer, Mr. Hawtayne, states that if the lowest tenders sent in are accepted, the total cost will be about £2,000 under what he originally estimated.

Westgate.—The District Council is to make application for a provisional order for electric lighting, and a meeting of ratepayers will consider the matter.

Wolverhampton.—A Local Government Board enquiry was held on Tuesday afternoon into the application of the Council for sanction to a £9,000 loan for electric lighting extensions. £882 of this sum has been overspent beyond the previous loan, and new buildings are to be put up for a 140-unit dynamo, steam exhaust pipes, fuse room, &c., amounting to £5,330; £1,000 will be spent upon extension of mains, &c.; £1,500 for extending to Chapel Ash, including a substation; contingencies, £288. The total capacity of the present plant is 15,100 8 C.P. lamps, and the new plant will add 4,000 8 C.P. lamps. Mr. F. Harman Lewis, the Borough Electrical Engineer, produced plans of the proposed works. The Town Clerk said that last year there was a profit of £224 on the undertaking.

Worthing.—At a meeting of the Town Council on Tuesday, the Electric Lighting Committee reported the receipt of a letter from Prof. Kennedy, stating that since his report to the Corporation of November 4th, 1894, an important improvement has been made in the manufacture of incandescent electric lamps, and having in accordance with the committee's request, reconsidered his estimate for the proposed works in the borough and the cost at which they could be carried out on the system which had now become possible, he found that a saving exceeding £4,000 might be effected, and a further sum of over £400 per annum at the commencement, in the annual cost. A letter was also read from Messrs. Crompton & Co., requesting to be informed whether the council would entertain the adoption of electric lighting on certain stated terms, the provisional order also obtained being transferred to them on payment of all the costs incurred in obtaining it. The committee informed the council that they purposed, before submitting any recommendation, to ascertain, as far as practicable, what number of the inhabitants resident within the compulsory area were prepared to take the electric light at or below the terms stated in the order. The report was adopted.

York.—The City Council held a special meeting on 25th inst. to consider the electric lighting matter. After discussion it was resolved to proceed with a municipal installation and accept the tenders as recommended by Prof. Kennedy in his report of January 7th. Application is to be made to the Local Government Board for a £20,000 loan. The voting was 26 for, 7 against, and 8 neutral. What has become of the opposition which was so very active a little time back.

ELECTRIC TRACTION AND MOTIVE POWER NOTES.

Another Underground Electric.—It is stated that surveys are being got ready for a deep-level electric railway, connecting the Brighton and South Coast lines at Victoria, with Euston, St. Pancras, and King's Cross terminal stations on the North-Western, Midland, and Great Northern Railways. The proposed line will pass through the heart of the West End, and will have a station in the Strand close to the great hotels and the theatres.

Barcelona and Madrid.—The contract for the electrical equipment (power house and rolling stock), of both the Barcelona and Madrid tramway systems, has just been placed with the British Thomson-Houston Company, Ltd. There will be 85 cars on the Barcelona system and 55 on the Madrid line, all operated on the overhead system.

Birmingham.—Various changes have been announced in the Birmingham papers in the management of the Birmingham City Tramways Company. Mr. J. A. Christie, of Leamington, has joined the board, and Mr. Granville C. Cuningham, late of Toronto, who recently read a paper before the British Association there, giving an account of the Montreal electric tramways, is to become managing director. Mr. Cuningham is a firm believer in the trolley, therefore it will be interesting to see what the future may bring forth at Birmingham, where the Council says it will not have that system.

The Clerk to the Aston District Council has called the attention of the Board of Trade to the many complaints made regarding the steam tramways, and has asked the Board to hold an inquiry into the subject.

Bristol.—On Saturday last the Earl of Jersey, Col. Boughey, and W. R. Fitzgerald, held an inquiry at Bristol into the application of the Bristol Tramway Company for an order under the Light Railway Act to construct a line from Kingswood to Hanham, on the outskirts of Bristol. In effect the proposal was to extend the present electric tramway from St. George to Hanham, a distance of about a mile and a half, deriving the power from the station at St. Georges, which supplies the current for both the Kingswood and Fishponds lines. The application was supported by the district to be served, which is entirely isolated from the city of Bristol except for busses which occupy an hour in doing the journey under favourable circumstances. The only point which the commissioners had to decide, and which was debated, was in respect to the absence of any purchase clause in the order asked for. The Town Council of Bristol intervened to raise this question, and their representative argued that the Light Railway Act was not intended to override and set at nought the purchase clause of the Tramway Act. The city had power to purchase the rest of the tramway undertaking of the company at the end of a fixed term, and it would be most inconvenient if there were sections with regard to which there were no conditions of purchase. On behalf the company, the purchase clause was opposed and there was an intimation that the insertion of purchase conditions defined by the Tramway Act would lead to the abandonment of the scheme. The Earl of Jersey called attention to a clause which had been inserted in an order in the Potteries district in which the term of purchase was fixed at 35 years. The Commissioners reserved their judgment.

Cardiff.—At the monthly meeting of the County Council held on Monday, the Town Clerk stated in reply to Mr. Good, that it was the intention of the Corporation to get a provisional order to enable them to purchase and take over and work the tramways. Alderman Carey moved, in connection with a resolution of the Electric Tramways Committee, that the words "And in the event of the Corporation deciding to apply next session for power to extend the boundaries of the borough, that authority be sought at the same time to construct and work the tramways indicated by dotted red lines on the aforesaid map" be rescinded, and that it be resolved in lieu thereof: "That the Parliamentary Committee be authorised to give an undertaking to the local authorities of the districts proposed to be added to the borough, that in the event of such districts being included within the borough boundaries the Corporation will apply to Parliament in the succeeding Session for powers to extend the tramways to those districts as indicated by the dotted red lines upon the borough engineer's plan, or as may be agreed upon." The speaker, in moving his resolution, gave facts showing the success of electric tramways in various big towns in the United Kingdom in which they had been laid down. Councillor Jenkins seconded, and the resolution was adopted *nem con.*

Clontarf.—Another trial trip over the Clontarf-Dollymount electric tramway took place on 22nd inst. The distance is 2¼ miles, and the journey occupied nine minutes. The power station is situated at Clontarf. The buildings are of Irish red brick, designed by Mr. H. F. Parshall, consulting engineer, and built by Mr. R. O'Connor. It stands on a large extent of ground, and is divided into three sections—the boiler house, the engine room, and the car house. The boiler house is 150 by 42 feet. A large skylight is let into the roof and extends the whole length of the house. The boiler plant consists of three boilers manufactured by Messrs. Babcock and Wilcox, Limited, each of which is capable of evaporating 6,500 lbs. of steam per hour at a working pressure of 155 lbs. The feeding water is taken from a large tank close at hand. A Green's economiser is used, and there are two Worthington's horizontal steam feeding pumps each capable of supplying water to the three boilers. On the left of the boiler house is the engine room. The equipment consists of three British Thomson-Houston generators, 150 kw., directly driven by Mackintosh-Seymour horizontal tandem compound engine running at the speed of 150 revolutions per minute. The installation is supplied with duplicate steam piping. The size of the engine house corresponds with that of the boiler room. Overhead is a 10-ton travelling crane manufactured by Jessop and Appleby, of Leicester. The electrical plant has been put up by the British Thomson-Houston Company, the contractors for the line. There is also a separate electrical plant for the lighting of the station. On the right of the boiler house is the car house, which has been constructed to accommodate 20 cars. Workmen are now employed bonding the rails from Annesley Bridge to the North Strand, in preparation for the extension of the electrical system to Nelson's Pillar, and the work has been completed for a short distance.

Chester.—The Town Council has had before it a proposal by the Trades and Labour Council to municipalise the tramways. The lease expires in two years. Councillors thought the matter might wait a little while. It has already been considered in committee and adjourned.

Dover.—Among the minutes of the Tramway Committee confirmed at the last Council meeting was the following:—"*Electric Current.*—A letter is read from Mr. Sellon as to the claim of the Electricity Supply Company, stating that although he considered the company were in a position to supply current on July 31st, all the requirements of the Board of Trade had not been completed until within the last week, and that they were therefore not till then in a position to supply current strictly in accordance with the terms of their contract, and the committee is recommended that a reply to this effect be sent to the company."

Dublin.—An inclusive contract has just been given the British Thomson-Houston Company, Ltd., for the entire equipment with electric traction of that portion of the tramway system which is now worked by horses. Our readers will recollect that two sections of the tramway system in Dublin have already been equipped by this firm, the latest of which is that running from Annesley Bridge out to Clontarf and Dollymount, the formal opening of which is to take place within the next few days. The other section referred to, viz., that from Ballsbridge to Kingstown to Dalkey, has been running successfully for some 18 months, and additional machinery is at this time being installed in the Ballsbridge station. The big scheme now decided upon will be served from a big central station, details of which are now being worked out. When the contract just closed by the Dublin United Tramways Company is completed, Dublin will be in the proud position of possessing the largest tramway system operated electrically in the British Isles, covering, as it will, over 110 miles of track, on which will be operated 200 motor cars

France.—The horse tramways in the town of Marseilles are to be converted into electric lines on the overhead conductor system, the contract for the work having been secured by the French Thomson-Houston Company.

Halifax.—The District Councils of Warley and Greetland have suggested extensions of the tramways to their districts, but the town clerk has advised them that it is too late to include these extensions in the new Bill, though they might be included in the next. The Board of Trade has returned the plans showing the mode of construction of the tramways authorised, with the approval of the department signified thereupon, subject to the condition that the width of the groove of the rail must not exceed 1 inch.

Light Electric Railways.—Under "New Companies" this week will be found particulars of the registration of a number of companies whose object is to lay down light electric railways in suburban and country districts. We learn that the Finchley District Electric Traction Company has given notice of its intention to apply to the Light Railway Commissioners for powers to construct and work light railways between the Metropolitan Railway Station, Finchley Road, Hampstead, and the adjoining suburbs of Finchley

and Hendon. It is also announced that it is proposed to construct a railway, with a 4ft. 8½in. gauge, from the tramway terminus at Acton Hill, through Ealing, and terminating at Hanwell Broadway. The British Electric Traction Company, Limited, has given notice of its intention to apply next month to the Light Railway Commissioners for an order to carry out the work.

Liverpool.—At a recent meeting of the Special Tramways Committee of the Corporation, it was moved "That the committee, after having a joint report from the City Electrical Engineer and the City Engineer on the subject, do not deem it desirable to have any line of underground electricity laid in the city until the Council have decided in what streets an underground system should be laid, and what system should be adopted, and therefore it is not desirable to accept the proposal of the Simplex Electric Tramway Conduit Syndicate, Limited, to construct an experimental line." An amendment to the effect that the offer of the Syndicate be accepted was proposed and seconded, but eventually defeated, and the original motion was carried.

Llandudno.—The District Council has approved of the proposal to apply to the Board of Trade for a provisional order to lay down tramways within the urban district of Llandudno, a letter received on the subject being submitted to the Electric Light Committee for consideration.

Middlesborough.—An inclusive contract for the equipment of the tramways, now being built between Middlesborough and Stockton-on-Tees, has been placed with the British Thomson-Houston Co., Ltd., which will include all the power house machinery, complete line equipment with 45 cars, and complete distribution system.

Motor Car Trial.—Mr. T. Parker and several gentlemen connected with Messrs. Parker, Limited, of Wolverhampton, in addition to a number of distinguished visitors, attended the works in Wednesfield Road, Wolverhampton, on Wednesday last, having been conveyed there from the station in Mr. Parker's new motor car. The main object of the visit was to test the capabilities of Mr. Parker's electric motor, which was in every way satisfactory. We understand that Mr. Parker, when on his motor car trips, has had a good deal of trouble with small boys, who, not satisfied with hanging on behind, have thrown sticks and stones into the mechanism whilst the car has been running.

The Electric Traction Undertakings of the A.E.G.—We have received from the Allgemeine Elektricitäts Gesellschaft in Berlin, a catalogue of the very extensive electric street railway undertakings that have been carried out, or are in course of construction by this firm. The total length of track recorded in the catalogue is 452·4 miles, and the total number of cars 1,276, which makes a good record for a single company when we consider how recently this form of traction has been introduced. The catalogue gives a number of useful particulars about each undertaking, such as length of track, number of cars, number of boilers and their heating surface, H.P. of engines, output of dynamos, &c., &c.

The Underground and Electric Traction.—A *Daily Mail* representative has interviewed an official of the Metropolitan Railway on the subject of electric traction, for the purpose of ascertaining what are the difficulties mentioned by Mr. Bell before the Board of Trade Commission, to whose report we referred at length a week or two ago. The official interviewed said the point referred to by Mr. Bell was, he imagined, the question of finding the initial energy for starting a large number of trains simultaneously on the same section. "There are 27 stations on the circle," he said, "and to start trains from several of these at the same time would require a considerable power from the source of supply. This difficulty will, of course, be overcome eventually; but electrical traction will not be utilised on the Metropolitan system for some little time. The subject is receiving the continuous attention of the directors, but it is naturally one that demands serious consideration. As soon as a decision is arrived at a definite announcement will be made."

Weston-super-Mare.—The members of the District Council inspected the electric tramway lines at Bristol on Saturday afternoon last.

TELEGRAPH AND TELEPHONE NOTES.

African Trans-Continental Telegraphs.—The African Trans-Continental Telegraph Company has received the following cablegram from Mr. Rhodes:—"Order another 500 miles of telegraph material. I will be through to Tete within three months.—C. J. Rhodes."

The Pacific Cable Scheme.—Yesterday's *Financial News* has an article on the rumours of the failure of the above scheme, which it says are groundless. The article reads as follows:—"From statements which have been recently gaining ground in submarine telegraph circles, there seemed to be some reason for supposing that one very important project lately discussed by Mr. Chamberlain with the Colonial Premiers was in danger of collapse. The Pacific cable enterprise, it has been stated, had been allowed to languish as a result of the Australian colonies having yielded to the pressure of certain interested arguments, with the result that a Franco-American combination would probably be formed to complete the scheme, thus allowing telegraphic communication between Canada and the Australian colonies to fall into hostile hands at a time when 'a mighty struggle for commercial supremacy on both shores of the Pacific Ocean must commence.' There does not seem to be, however, any danger of such a catastrophe. The Colonial Office knows nothing of the suggested Franco-American combination of which the alarmists stand in dread; on the contrary, writes a correspondent of the *Financial News*, the department has every confidence that the scheme will be duly carried out by each of the three parties to it. When Mr. Chamberlain discussed the subject of the proposed cable with the Premiers, he pointed out to them that a committee had been appointed to consider the subject, and that a report had been presented to their respective Governments. 'It therefore remains with you,' he added, 'to consider whether you will take action upon it.' The Australasian Premiers agreed with that view of the case, but they found it impossible, in the multitude of their Jubilee engagements, to definitely determine what they would be prepared to do in the matter. 'The result is,' as it was explained to our correspondent yesterday, 'the Secretary of State now awaits communications from them on the subject.' 'And when do you think they are likely to be received?' he inquired. 'Well, the Australasian colonies are a long way off; besides, since their return the Premiers have had their hands full of the subject of Australian Federation. We shall hear from them in due course, no doubt.' 'And the scheme they are to consider?' 'Is for the construction of a telegraph cable from Vancouver (British Columbia) through the various islands of the Pacific Ocean to the coast of Australia, each of the three parties—namely, Great Britain, Canada, and the Australasian colonies—contributing to the expense.' 'Then, can you explain the mysterious hint at a possible Franco-American combination?' 'That has reference to two Bills before the Congress of the United States; but they have not come to anything at present. The British scheme is quite independent of any scheme of that kind. The American scheme is for the construction of a cable from San Francisco; they are quite at liberty to construct it—in fact, the more cables the better for us. On our side we must wait until each of the three parties is agreed.' 'And what of France?' 'So far as I know, there has been no official discussion of such an enterprise in France, and it is not quite clear that the French Government has anything to gain by the construction of such a cable.' 'But may it not be a scheme that French private speculation has in contemplation?' 'There are telegraph cable companies in France, of course; but I think this would be rather far afield for them.' 'Then we can safely rest assured that 'the next big job to be wrested from the British,' as the alarmists have put it, is safe for the present?' 'Undoubtedly. What is meant by "interested arguments" I do not in the least understand, nor have I the faintest notion whence the "arguments" emanate.'"

Telegraphic Interruptions and Repairs:—

Cables.	Down.	Repaired.
Brest-St. Pierre (Anglo, 1869)	April 6th, 1893 ...	...
West Indies—		
St. Croix-Trinidad ...	Nov. 30th, 1896 ...	...
Cayenne-Pinheiro (Brazil)	Sept. 29th, 1897 ...	...
Paramaribo-Cayenne ...	Oct. 25th, 1897 ...	...
Amazon Company's cable—		
Parintins-Itacatiara ...	May 5th, 1896 ...	...
Obidos-Parintins ...	Dec. 7th, 1896 ...	...
Cable beyond Santarem ...	Oct. 23rd, 1897 ...	...
Hong-Kong-Macao	Sept. 28th, 1897 ...	...
Otranto-Vallona	Oct. 11th, 1897 ...	...
Mozambique-Lourenzo Marquez	Oct. 18th, 1897 ...	Oct 20th, 1897.
Cadiz-Teneriffe	Oct. 26th, 1897 ...	...
Landlines.		
Trans-Continental line beyond Masol	March 12th, 1896 ...	...
Carthagena-Barranquilla (Columbia)	July 4th, 1897 ...	...

CONTRACTS OPEN AND CLOSED.

OPEN.

Austria.—November 5th. An electric power transmission plant is about to be put down at the Austrain State Railway Workshops at Pilsen, and tenders are being invited for the supply of the necessary plant. Tenders are to be sent to the Kundk, Staatsbahn Direction, Pilsen, Austria.

Ayr.—November 11th. Tenders are invited by the Corporation from firms willing to undertake the free wiring of houses in the burgh. Electrical engineer, Mr. A. J. Fuller. See our "Official Notices."

Blackpool.—November 22nd. The Corporation wants tenders for various works required in the conversion of the present system of electric traction. There are four sections as follows:—

A. Steel columns, brackets and straining posts.
B. Trolleys, trolley wire and indicators.
C. Controllers, motors and gearing.
D. Mains and section fuses.

Borough electrical and tramway engineer, Mr. Robert C. Quin. See our "Official Notices" for further particulars.

Burnley.—November 17th. The Corporation invites tenders for the supply and delivery of lead-sheathed, armoured, underground cables. Borough Electrical Engineer, Mr. W. R. Wright. See our "Official Notices" last week.

Dewsbury.—November 2nd. The Corporation want tenders for the supply of coal for the electricity works for twelve months from January 1st next. Particulars from the electrical engineer, Bradford Road.

France.—November 3rd. Tenders are being invited by the 1900 Exhibition Authorities in Paris for a complete installation of electric lighting in the Exhibition Administration Offices at the corner of the Avenue Rapp and the Quai d'Orsay. Particulars from, and tenders to, the Secretariat Général de l'Exposition Universelle de 1900, 26, Avenue de la Bourdonnais, Paris.

Hull.—November 5th. The Corporation invite tenders for the electrical equipment of their tramways, to the extent of about 9 miles double track and ½ mile single track. The contract will not be divided, and will include engines and generators, switchboards, feeders, poles, brackets, trolley wire, rail bonding and all accessories, also the first instalment of cars (15 motor cars and 5 trailers). City engineer, Mr. A. E. White. City electrical engineer, Mr. A. S. Barnard. See our "Official Notices" September 17th.

Queensland (Aus.).—November 15th. The Municipal Council of Ipswich, Queensland, is inviting tenders for the supply and erection of the following electric lighting plant, &c.:—Tubular boilers, pipes, pumps and heaters, alternators and exciters, switchboard, high and low tension mains, junction boxes, transformers, &c. Specifications, and all particulars as to conditions, &c., may be obtained from Messrs. Gordon & Gotch, St. Bride Street, Ludgate Circus, London, E.C., and tenders have to be forwarded to the Town Clerk (Mr. Albion Hayne), Council Chambers, Ipswich, Queensland. See "Official Notices" September 17th.

Roumania.—November 15th. Tenders are being invited by the Municipal Authorities of Ploesti, for the concession for the establishment and working of an electricity generating station in the town during a period of 40 years, for private and public lighting and also for power transmission purposes.

Russia.—November 1st. The Municipal Authorities of Novorossisk, South Russia, are inviting tenders for the concession for the construction and working of an electric tramway and for the electric lighting of the town.

Shoreditch.—November 2nd. The Vestry invites tenders for the supply and erection of additional engines and high tension continuous current generators, and an extension of the existing switchboard. See our "Official Notices" October 15th for particulars.

Spain.—November 3rd. Tenders are being invited by the Municipal Authorities of Aznaga (province of Badajoz), for the concession for the electric lighting of the public streets of the town during a period of 25 years. Tenders to be sent to El Secretario del Ayuntamiento de Aznaga (Badajoz).

St. Pancras.—November 2nd. The Vestry want tenders for the supply and fixing of additional plant at the Regent's Park electricity works, comprising dynamos, engines and switchboards. See our "Official Notices" October 15th.

Victoria.—November 10th. The Agent-General for Victoria is inviting tenders for the supply of electric light cables and fittings, for the Railway Department of the Colony. Specifications, &c., obtained at the Offices of the Agent-General.

CLOSED.

Brighton.—From the tenders sent in for electric fitting and wiring at the administrative building of the new Sanatorium, that of Mr. T. King has been selected by the Council for acceptance, at £170. The other tenders were from Messrs. Reed & Son, £186; Mr. Coat, £194; Messrs. Page & Miles, £198; Messrs. Hawkes and Walton, £225.

Hammersmith.—The Vestry has given the contract for the electric fitting and wiring at Shepherd's Bush Library to Mr. Hellyar, at £90 odd.

Huddersfield.—The contract for the electric wiring and fitting of the Free Library and Art Gallery for the Town Council, has been given to Messrs. Read, Holliday & Sons, at £87.

Hull.—The Electric Light Committee has given an order for a boiler for the electricity works to the Earle's Shipbuilding Company, at £835.

FORTHCOMING EVENTS.

1897.

Friday, October 29th.—Physical Society. Opening meeting for the session.

Friday, October 29th, at 2 o'clock.—Meeting of the Automatic Telephone Company at Winchester House, E.C.

Friday, October 29th, at 8 p.m.—Electro-Harmonic Society Smoking Concert at St. James's Hall Restaurant (Banquet Room), Regent Street, W.

Monday, November 1st.—Indo-European Telegraph Company. Interim dividend payable.

Monday, November 1st.—Callender's Cable and Construction Company. Interim dividend payable.

Tuesday, November 2nd.—Last day for receipt of tenders for Shoreditch electric lighting extension plant.

Tuesday, November 2nd.—Last day for receipt of tenders for St. Pancras extension plant.

Tuesday, November 2nd, at 7.45 p.m.—The first of a series of lectures by J. Fletcher Moulton, Esq., Q.C., on "Patent Law," will be delivered at the Middle Temple Hall.

Wednesday, November 3rd.—Institution of Mechanical Engineers' ordinary general meeting at 25, Great George Street, Westminster, for reading and discussion of papers as follows:—"Experiment upon Propeller Fans, and upon the Electric Motor driving them," by Mr. William George Walker, of London. Adjourned discussion and supplementary paper. "Diagram Accounts for Engineering Work," by Mr. John Jameson, of Newcastle-on-Tyne.

Thursday, November 4th.—Institution of Mechanical Engineers' ordinary general meeting at 25, Great George Street, Westminster. Paper on "Mechanical Features of Electric Traction," by Mr. Philip Dawson, of London.

Thursday, November 4th, at 8 p.m.—Chemical Society, Burlington House. Papers to be read:—"The Properties of Liquid Fluorine," Professors H. Moissan and J. Dewar. "The Liquefaction of Air and the Detection of Impurities," Prof. Dewar. "The Absorption of Hydrogen by Palladium at High Temperatures and Pressures," Prof. Dewar.

Friday, November 5th, 8 p.m.—The Institution of Junior Engineers at the Westminster Palace Hotel. Inaugural meeting of 17th session. Presidential address by John A. F. Aspinall, Esq., M.Inst.C.E.

Friday, November 5th.—Last day for receipt of tenders for Hull electric tramway equipment.

Monday, November 8th, at 7.30 p.m.—Institute of Marine Engineers, 58, Romford Road, E. Paper by Rev. M. Capell, on "Fans."

Tuesday, November 9th.—Last day for receipt of applications for appointment of electrical engineer to the Glasgow Corporation.

NOTES.

Correspondence.—We have received too late for insertion in this issue, a letter from Mr. A. B. Pescatore on "Tudor Batteries," and one from Messrs. Sax, Slatter & Co., Limited, replying to Messrs. Julius Sax & Co.'s letter of last week.

Lectures on Patent Law.—A very important course of six lectures is to be delivered by J. Fletcher Moulton, Esq., Q.C., on "Patent Law," under the auspices of the Council of Legal Education, in the Middle Temple Hall. The first lecture will be delivered on Tuesday, November 2nd, at 7.45 p.m., and the lectures will be continued at the same hour on subsequent Tuesdays. The following is a syllabus of the lectures:—

Lecture I.—Nature of Grant by Letters Patent.—Their Legal Status prior to Act of Monopolies.—Effect of that Act.—Practice and Procedure in the Sixteenth and Seventeenth Centuries.—Modern Developments.—Legal Status of Letters Patent under Existing Law.

Lecture II.—The Invention.—Difficulty of Definition of the word "Invention."—Essential Characteristics of a Patentable Invention.—Negative Canons Derivable from Judicial Decisions.—Delimitation of the Invention in the Specification.—Origin and Function of Claims.—Their Interpretation.—Colourable Imitation.

Lecture III.—Conditions of Validity.—1. Novelty:—Prior User.—Secret User.—Experimental User.—Prior Publication.—Its Sufficiency.—Conflicting Decisions.—Distinction between Public Knowledge and Common Knowledge.—Publication by the Inventor Himself.

Lecture IV.—Conditions of Validity (*continued*).—(2) Sufficiency of Specification:—Double Duty of the Patentee.—Difficulties arising therefrom.—Examples.—(3) Utility:—Origin and Nature of the Condition.—Meaning of the Term in Patent Law.—Commercial Utility.—(4) Conformity:—Origin and Nature of the Condition.—Fair Development.

Lecture V.—Procedure.—Mode of Obtaining the Grant.—Amendment of Grant.—Revocation of Grant.—Rights and Remedies of Patentee.—Rights and Remedies of Public.—Action for Threats.—Compulsory Licences.

Lecture VI.—Defects of English Patent Law.—Foreign Systems.—Relative Advantages. — Possible Improvements. — International Rights.

The lectures will be open to all members of the Inns of Court free, and to gentlemen non-members on payment of a fee of one guinea for the course. Tickets to be obtained at the office of the Council, Lincoln's Inn Hall, W.C.

Mr. Maxim's New Lamp.—A correspondent of the *Financial News* says:—"Mr. Hiram S. Maxim, the inventor of the Maxim gun and of cordite, and one of the earliest pioneers of electric lighting in the States, has recently perfected some improvements in electrical illumination, for which he claims advantages over every other known system, and which, he says, will reduce the item of cost of such illumination to the level of, if not below, that of common gas. The new Maxim lamp takes only 2·8 watts to the candle-power. It is believed that this invention, which includes a new filament and lamp, will create some noise in the electric lighting world. It can be applied to every existing system, and may, perhaps, be welcomed alike by the various companies that produce and the public who use electricity for illuminating purposes." Time and experiment, of course, will show.

Electric Lighting at the Law Courts.—The corridors and offices occupied by the officials of the Crown Office and the Associates Department at the Royal Courts of Justice are in future to be lighted with supply from the mains of the Electric Lighting Company, instead of from the private plant which has been employed for some time.

Belgian Honours for Prof. Hughes.—We learn with pleasure that the Belgian Government has advised Prof. D. E. Hughes that H.M. the King of Belgium has conferred upon him the decoration of "Officier de l'ordre Leopold." We understand that this mark of appreciation is due to Prof. Hughes' labours in connection with his printing telegraph instrument, which the Belgian Government has largely used during the last 27 years. The following is a literal copy of the message from the Minister of Railways, Posts, and Telegraphs:—

Brussels, October 19th, 1897.

Monsieur le Prof. D. E. Hughes.

L'Administration des Telegraphes vous addresse ses plus vives félécitations a l'occasion de votre nomination d'officier de l'ordre Leopold.

VANDENPEGREBOOM,
Ministre des Chemins de Fer Postes et Telegraphes.

Prof. Hughes has our hearty congratulations.

The Institution of Junior Engineers.—The annual general meeting of this progressive Institution was held at the Westminster Palace Hotel on Friday, October 22nd, Mr. H. B. Vorley, Chairman of the Council, presiding. After the usual preliminary business, the Council's report was read by the secretary, Mr. W. T. Dunn. It contained a very satisfactory record of the proceedings of the society during the past year, 68 new members had been elected, and, after allowing for removals of names from the register, the total membership at the present time was shown to be 480. Seven meetings for the reading and discussion of papers had been held, eleven visits to engineering works in the London district had been made, and numerous other works had been seen during the summer meeting in the North of Ireland. The Institution premium had been awarded to Mr. W. R. Beckton for his paper on "The protection of buildings, &c., from fire." The congratulatory address to the queen, the conversazione, anniversary dinner, office fund, financial position, and sanitary congress, were other matters referred to in the report, and an appreciative allusion was made to the services rendered by Mr. H. Kempster now retiring from the post of librarian which he had ably filled for the past two years. It was announced that Sir A. R. Binnie, the retiring president, would be succeeded by Mr. John A. F. Aspinall, Chief Mechanical Engineer to the Lancashire and Yorkshire Railway, and that the election of officers had resulted as follows:—Chairman, Mr. H. B. Vorley; vice-chairman, Mr. Basil H. Joy; hon. librarian, Mr. J. N. Boot; hon. auditors, Messrs. W. H. De Ritter and P. Marshall; members of council, Messrs. Walter J. Hunter, A. Marshall, R. Marshall, and L. H. Rugg.

Appointment.—Mr. C. A. Midgley, of the Leeds Electricity Works, has been appointed assistant electrician to the Wakefield Corporation. There were 23 applicants for the post.

Lectures.—At the Technical Institute, West Norwood, on 20th inst., Dr. Laurie delivered the first of a series of lectures on "Electric Light and Power."

The Glasgow Telephone Inquiry.—We continue the publication of the evidence in this inquiry, which we expect to complete in our next week's issue. The operators explained the circumstances under which subscribers might remain "engaged" by reason of the neglect to call off. Only the calling subscriber could call off, and if he neglected both were engaged. There was no doubt that the misuse of the call wire by subscribers caused a great deal of the difficulty in getting connection, and the behaviour of the subscribers frequently caused the operators to go into hysterics. Mr. Gaine, the general manager and solicitor of the company, gave a history of the introduction of telephony into this country, and explained the present position of the company in relation to its license and the facilities for underground mains given by various municipalities, but which Glasgow refused. In event of a rival system being established the company would certainly charge terminal fees. The statistics he had put in, and the enormous use that was being made of the service, showed that it was not inefficient. He also criticised Mr. Bennett's estimate, and observed, with reference to the answers from subscribers, that nine out of ten subscribers to any public service will say they are not satisfied, if invited by letter to express their opinion. In the evidence published in this issue, Mr. Gaine's cross-examination is continued on the relative advantages of overhead and underground systems, and the protection of the municipality in permitting the latter. Dr. John Hopkinson expressed the opinion that in the interest of the community there should be an underground metallic system. Mr. Dane Sinclair submitted a statement showing the number of faults in Glasgow in three years through building operations and other causes, which were more numerous than those caused by storms, gave other evidence on technical points, and also criticised the estimate submitted by Mr. Bennett. Lord Overtoun and other witnesses expressed their satisfaction with the company's service, and objected to the municipality undertaking it. Mr. Crawford Miller, the local manager in Glasgow, explained the method of dealing with complaints, of which the most frequent causes was failure to call off.

England versus the Continent.—The Manchester City Council last week listened to the report (to which we have already referred) of some of their members, who have been visiting the German and Austrian Technical Schools.—Alderman Higginbottom said it was a mistaken notion to suppose that Manchester was the home of engineering. In all the electrical installations he had seen on the Continent, the engines and apparatus were of foreign manufacture, and he had never seen finer engines anywhere than he had seen abroad.—Councillor Phythian, speaking as a member of the A.S.E., said that prior to his visit to the Continent, he had maintained that English firms could make the best engines and the best dynamos. He had come back, however, with an altered opinion, and was bound to admit that he had seen work which would put to shame a great deal of the work done in this country.—Remarks of a similar nature were made by other prominent members of the Council.—At the close the report of the Technical Instruction Committee on German and Austrian Technical Schools was adopted.

The Siemens Engineering Society.—This society has been formed among the employés of Messrs. Siemens Bros. and Co., Limited. The inaugural meeting was held at the Charlton Assembly Rooms on the 19th inst., when the President, Mr. Alexander Siemens, delivered an address, in which he gave the history of the formation of the firm, its rise and progress, and the attainment of its present position. Mr. Frank Ayton is the honorary secretary. The address was followed by a musical programme, and during the course of the evening a presentation was made to Mr. W. L. Phillips, one of the technical staff, who is proceeding to Australia in connection with the firm's Sydney branch.

Rhodin's Patent Electrolytical Apparatus.—We understand that the patent for the above process, which we describe in another part of this issue, is the property of the Commercial Development Corporation, Limited.

Chicago Electrical Papers.—Some good subjects are down for papers before the Chicago Electrical Association's fortnightly meetings. Among those which have been, or are to be read, are the following:—

October 1st.—"Economy in Electric Car Control," by James R. Cravath.
October 15th.—"Evolution of the Isolated Electric Plant," by Harold Almert.
November 5th.—"The Safe Current Capacity of Electrical Conductors," by C. H. Sewall.
November 19th.—"Daily Mechanical Conveniences," by S. G. McMeen.
December 3rd.—"Heavy Electric Traction," by Cloyd Marshall.
December 17th.—"Electricity in Shipbuilding," by C. C. Mattison.
January 7th.—"Electrical Shop Transmission," by H. G. Dimmick.
January 21st.—"The Art of Constructing Telephone Apparatus," by Henry P. Clausen.

Correction.—In our note of last week headed "Brussels Exhibition," a printer's error makes us say that Messrs. Elliott Bros. had been awarded "second grand prize." This should read "two grand prizes."

Personal.—Mr. W. L. Phillips, who for the past five years has been on the Woolwich staff of Messrs. Siemens Bros. & Co., has been transferred to an important post in the Sydney branch of the same firm. Mr. Phillips is a native of Australia, and left Melbourne some years ago, after having had an all-round engineering training, to obtain electrical experience in England. He has had charge of the erection of several municipal central stations, and carried out useful research work on behalf of Messrs. Siemens. Previous to his departure on Friday last per ss. *Arcadia*, he was presented with a slide rule and several technical works by his colleagues on the staff.

Mr. Dennis G. Shephard has severed his connection with the Brush Electrical Engineering Company at Loughborough, having been appointed chief engineer to the Otis Elevator Company, Limited, of 4, Queen Victoria Street, E.C.

The Engineers' Strike.—As we go to press we learn that notice—expiring on Saturday—has been served on 200 members of the A.S.E. at the works of Marshall, Sons & Co., Gainsborough.

NEW COMPANIES REGISTERED.

G. R. Blot & Co., Limited (54,459).—Registered October 16th with capital £75,000 in £1 shares, to acquire Patent No. 10,169 of 1894, granted to G. R. Blot for "Improvements in secondary batteries or electric accumulators," to adopt an agreement with G. R. Blot, and to carry on the business of electrical and mechanical engineers, and electricians. The subscribers (with one share each) are:—A. Pike, 33, St. Swithin's Lane, E.C., clerk; E. A. Deane, 2, Merrick Square, Borough, S.E., clerk; A. T. F. Andrews, 33, St. Swithin's Lane, E.C., clerk; L. Lefebvre, 33, St. Swithin's Lane, E.C., gentleman; W. Aubanel, 47, Brondesbury Road, N.W., clerk; T. Collet, 33, St. Swithin's Lane, E.C., gentleman; H. H. Borel, 33, Wimpole Street, W., engineer. The number of directors is not to be less than three nor more than seven; the first are T. Parker, F. H. Kirby, and E. Honey; qualification £500; remuneration as fixed by the company. Registered by Honey & Mellersh, 33, St. Swithin's Lane, E.C.

Folkestone District Electric Railways Company, Limited (54,506).—Registered October 20th with capital £20,000, in £10 shares, to construct, lease, or otherwise acquire, equip, maintain, and work with electrical or other power, any light railways or tramways at Folkestone or elsewhere in Kent. The subscribers (with one share each) are: E. Lazarus, 83, Cannon Street, E.C., chairman of company; T. R. Thompson, 67, Cornhill, E.C., merchant; W. Martindale, Ingatestone, Essex, gentleman; J. F. Nauheim, 56, Canfield Gardens, Hampstead, N.W., gentleman; A. R. Monks, 21, Park Avenue, Willesden, director; J. Devonshire, 2, Stafford Terrace, Phillimore Gardens, W., gentleman; W. Morris, jun., 17, Throgmorton Avenue, E.C., gentleman. The number of directors is not to be less than three, nor more than seven. The subscribers are to appoint the first; qualification, £200; remuneration as fixed by the company. Registered office, 83, Cannon Street, E.C.

Rochester, Chatham, Gillingham and District Electric Railways Company, Limited (54,507).—Registered October 20th with capital of £20,000 in £10 shares, to construct, lease, or otherwise acquire, equip, maintain, and work by electrical or other power, any light railways and tramways in the County of Kent, or elsewhere. The subscribers (with one share each) are: E. Lazarus, 83, Cannon Street, E.C., chairman of company; T. R. Thompson, 67, Cornhill, E.C., merchant; W. Martindale, Ingatestone, Essex, gent.; J. F. Nauheim, 56, Canfield Gardens, Hampstead, gent.; A. R. Monks, 21, Park Avenue, Willesden, director; J. Devonshire, 2, Stafford Terrace, Phillimore Gardens, W., gent.; W. Morris, jun., 17, Throgmorton Avenue, E.C., gent. The number of directors is not to be less than 3 nor more than 7; the subscribers are to appoint the first. Qualification, £200; remuneration as fixed by the company. Registered office, 83, Cannon Street, E.C.

Hastings, Bexhill and District Light Railways (Electric) Company, Limited (54,552).—Registered October 23rd with capital £10,000, in £10 shares, to make, construct, equip and work with electrical or other power any light railways or tramways in Sussex or elsewhere. The subscribers (with one share each) are:—W. Anderson, Glenavon, Merrion Road, Dublin, secretary; W. Carter, J.P., Military Road, Dublin, chairman of company; W. M. Murphy, 39, Dame Street, Dublin, director; J. J. O'Connor, Sackville Street, Dublin, merchant; J. E. Waller, 29, Great George Street, S.W., engineer; J. B. Glenn, 7, Poultry, E.C., secretary; J. Hall, 20, Kitson Road, Camberwell, accountant. Table "A" mainly applies. Registered by J. B. Glenn, 7, Poultry, E.C.

Bournemouth, Poole and District Light Railways (Electric) Company, Limited (54,550).—Registered October 23rd with capital £10,000 in £10 shares to make, construct, equip, and work with electrical or other power any light railways or tramways in Hants or elsewhere. The subscribers (with one share each) are: W. M. Murphy, J.P., 39, Dame Street, Dublin; J. B. Glenn, 7, Poultry, E.C., secretary; J. Hall, 20, Kitson Road, Camberwell, accountant; S. Bates, 17, Stirling Road, Tottenham, accountant; A. L. Hoskins, 123, Algernon Road, Lewisham, accountant; A. A. Tyler, 227, Coldharbour Lane, S.W., manager; E. F. V. Knox, M.P., 5, Paper Buildings, Temple, E.C. Table "A" mainly applies. Registered by J. B. Glenn, 7, Poultry, E.C.

Finchley District Electric Traction Company, Limited (54,451).—Registered October 23rd with capital £10,000, in £10 shares, to make, construct, equip and work with electrical or other power any light railways or tramways in Middlesex or elsewhere. The subscribers (with one share each) are: W. M. Murphy, J.P., Dartrey, Rathmines, Dublin; J. B. Glenn, 7, Poultry, E.C., secretary; A. A. Tyler, 227, Coldharbour Lane, S.W., manager; E. F. V. Knox, M.P., 5, Paper Buildings, Temple, E.C.; E. Wragge, 4, Marlborough Hill, St. John's Wood, C.E.; A. L. Hoskins, 123, Algernon Road, Lewisham, accountant; S. Bates, 17, Stirling Road, Tottenham, accountant. Table "A" mainly applies. Registered by J. B. Glenn, 7, Poultry, E.C.

CITY NOTES.

Eastern Extension, Australasia and China Telegraph Company, Limited.

The half-yearly general meeting of this company was held at Winchester House on Wednesday last, the Marquis of Tweeddale in the chair.

In his opening remarks, the Chairman referred to the death of Mr. C. Earle. The gross revenue for the half-year ended June 30th last had been £290,749, showing a decrease of £23,165, as compared with that for the corresponding period of 1896. This result was, however, much more favourable than was anticipated when they decided to make the extensive reductions of tariff that were brought into force last year and at the beginning of the current year. The loss estimated from these reductions was, in round figures, £31,000 for the half-year, and the actual loss had been £29,745. In addition to this, there had been a falling off in the Australasian and other traffics amounting to £9,304, increasing the total loss for the half-year to over £39,000. The Manila traffic, however, owing to the recent disturbances in the Philippine Islands, had been abnormally heavy during the half-year, and there had also been increases in the Japan and China traffics. A further heavy fall in the value of silver had cost them a loss of nearly £17,000 through short collections at the currency stations. They had devised means to guard against loss through violent fluctuations in future. The working expenses had amounted to £99,425, showing an increase of £12,169 over those of the corresponding period of 1896. This was mainly accounted for by the fact that the expenses attending the maintenance of the cables had been considerably higher during the past half-year than in the corresponding period of 1896. In addition, there were items of exceptional expenditure in connection with donations, negotiations, &c., that were absent from the accounts for the corresponding half of last year. The usual interim dividends at the rate of 5 per cent. had been paid for the past half-year, amounting to £62,500, and after transferring £75,000 to the general reserve fund, £34,812 would be carried forward. They would have learnt from the report that the Queensland Government had decided to take part with the other Australasian Governments in the guarantee arrangements entered into with the company, and had thus enabled them to give the colony of Queensland the benefit of the cheap tariff established a few years ago for the guaranteeing colonies, and on July 1st last the tariff between Queensland and Europe was reduced from 9s. 5d. to 5s. 1d. per word. When he last addressed them he mentioned that the Commission appointed by the Imperial and Colonial Governments to consider the question of laying an "all-British" cable across the Pacific had concluded its labours, but that its report had not been made public. This report was still withheld, but according to the news-

papers, the question was under consideration at the conferences held between Mr. Chamberlain and the Colonial Premiers a few months ago, together with the counter-proposal which the Eastern, Eastern Extension, and South African Companies had submitted to Her Majesty's Government for an "all-British" cable between Great Britain and Australia *viâ* the Cape of Good Hope. This cable would at the same time bring into telegraphic communication the important coaling stations of St. Helena and Ascension, as well as other British possessions at present unconnected by cable. This project had, he said, many advantages over the proposed "all-British" communication with Australia from Canada *via* Fanning Island, and appeared to be preferred to the Pacific scheme—at any rate by some of those who were chiefly interested. The whole question was, however, to be considered by a departmental committee, and he was not therefore at liberty to discuss the matter in any detail at the present moment; but they might rest assured that their interests were being carefully watched by the directors, and any decision that might be come to in relation to this important matter would be intimated to them as soon as possible. The contract entered into with the Dutch Government, to which reference was made at the last meeting, for the manufacture and laying on behalf of the Netherlands Government of two short cables in Netherlands-Indian waters had been carried out during the half-year under review to the entire satisfaction of the authorities. He thought they would consider the report he had been able to submit to them a satisfactory one. Their cables were in very good condition; the traffics were very satisfactory, considering the reduction in rates.

The report was then adopted.

Accumulatoren-Fabrik Aktiengesellschaft.

The report to be laid before the ordinary general meeting of this company on October 29th, states that for the year 1896-97 the gross receipts in their three establishments at Hagen, Vienna and Buda Pesth, have been £279,925, as against £217,825 for the previous year. This increase in the gross receipts is ascribed to the generally improved state of the industry, but chiefly to the reduction of prices which this company made in February, 1896. The number of installations fitted up, or on the books, has risen in the past year to 6,132, among which are a considerable number of central stations. Moreover, in the past year, a new market for accumulators has been opened by their application as equalisation or buffer batteries in power stations, more especially in tramway power stations. Great strides have been made by the company in the introduction of accumulators for electric traction. The following are lines already fitted up: On the mixed system, Hanover with 117 cars, and Dresden with 36 cars; on the exclusively accumulator system, Paris with 35 cars, Copenhagen with 18 cars, Hagen with 8 cars. Orders have been received to supply on the mixed system, Hanover with 34 cars, Dresden with 31 cars, and Berlin with 50 cars; and on the exclusively accumulator system, Turin with 42 cars, Hagen with 20 cars, and Ludwigshafen (light railway) with two cars. The street railways at Hagen have been taken over by this firm in conjunction with Siemens & Halske, and converted into a joint stock company. Horse traction is being replaced by electric traction, a change which will be completed by April 1st next year. A Russian company has been started at St. Petersburg to manufacture Tudor accumulators, with the view of saving the heavy import tariff. Last May the headquarters of the company were removed from Hagen to Berlin. Out of the profits for the past year the company pays 5 per cent. to their first reserve fund, and a dividend of 10 per cent. on their capital of £225,000. To a second reserve fund is paid £2,000, and a slightly larger sum than that of last year is carried forward to the next account.

Brazilian Submarine Telegraph Company, Limited.

The fortnightly ordinary general meeting of the shareholders of the Brazilian Submarine Telegraph Company, Limited, was held on Wednesday, at Winchester House, Sir Albert J. Leppoc Cappel, K.C.I.E., presiding.

In moving the adoption of the report, the Chairman said the receipts for the half-year ending June 30th were £79,133; for the previous half-year they were £88,973, showing a decrease of £9,840. The receipts from messages showed a decrease of £10,050, and those from interest, rents, transfer fees and dividends on shares in other telegraph companies an increase of £210, resulting in a net decrease, therefore, of £9,840. That decrease was hardly a matter of surprise, as its probability was pointed out at the last meeting. It was due to the same causes that had worked against them for some considerable time, viz., stagnation of trade in South America, keener competition for the small traffic available, and a still further fall in the gold value of the Brazilian currency. During the half under review, the value of the Milrei ranged from 8¾ to 7½, and averaged 8d., or about ⅛ths of a penny less than in the previous six months. Compared with the receipts of the corresponding half-year of 1896, the decrease was £12,938. The difference in the exchange value of the Brazilian currency was then even greater than in the first half of last year; it averaged $9\frac{5}{16}$d. against 8d. that half-year. Turning to the expenditure side of the accounts, the total gave £20,505, which, compared with £21,090 last half, showing a decrease of £585. He had a statement showing the increases and decreases in the various items, but he would not trouble them unless they wished it. He would remind them, however, that £605, which was voted by the shareholders at the last meeting to the International memorial to Sir John Pender and the Prince of Wales's Hospital Fund, was included in the expenditure referred to. After providing for the debenture interest, sinking fund, and income tax there was a balance of £53,947. To that was added the balance on December 31st, namely, £15,274, making together £69,221. The interim dividend paid in March amounted to £19,500; they had transferred to reserve revenue fund £100,000, and there was left a balance to be dealt with of £39,721. From that amount the directors recommended a distribution of a final dividend for the year of 3s. per share, and a bonus of 2s., which, after being paid, would leave £7,221 to be carried forward. He was glad to inform them that through the arrangements made at the International Telegraph Conference for July 1st, they had provided for an increased collection of currency whenever it was below the par of gold. He was glad to say that the current half-year showed not only an increase in the receipts, owing to that cause, but also an increase in the amount of traffic dealt with, and there was every indication of the improvement continuing. The absence of any event of consequence in the history of the half-year made his position a little difficult, because it deprived him of any chance of making any remarks of interest to them. The defect in the No. 1 Lisbon-Maderia cable still existed, but as the cable continued to work satisfactorily, they did not propose to go to the expense of removing the fault for the time being. During the past half-year they had been happily free from disturbance, and consequently there was no expenditure for repairs. During the current half-year they had been less fortunate, for on October 7th a break occurred in the St. Vincent-Pernambuco No. 1 cable. The repairing steamer *Duplex* was at once chartered, and reached the spot on the evening of October 15th, and the cable was repaired on the 17th, and was now working perfectly. The allied companies in which they had interest, connecting their system with the West Coast of Africa and the South of America, continued to act as efficient feeders to their system. The cable of the German Submarine Company was working satisfactorily, and fully justified the company taking so large a share in the undertaking. It had not only brought valuable traffic to their system, but they would have the further benefit of the dividend on their investment at the end of the year. Their position was a strong one and their prospects very promising, for notwithstanding what he said at the beginning of his remarks, they had been able to distribute out of the profits 7 per cent. in dividends and bonus. The vast countries in South America, with their enormous capacity for production, must continue to progress in spite of all drawbacks. They were splendidly equipped and had an excellent staff, and had acquired a deservedly high reputation for efficiency, while thanks to the wise policy of maintaining a large and increasing reserve, they were striving to protect and advance their interests and cope with any emergency.

Mr. F. Youle seconded the motion, and it was carried.

Companies to be Struck Off the Register.

Mr. J. S. Purcell, the Registrar of Joint Stock Companies, publishes in the *London Gazette* of October 22nd, a list of the companies which were on the 22nd inst. struck off the Register. The following is a list of those connected with the electrical industry, which are included:—

British and Foreign Electric and Engineering Company.
Electric Battery Company.
Electro-Hygienic Company.
English and Colonial Electric Light Company.
Fulgur Electric Lighting Company.
Hall Electrical Company.
Hampstead General Electric Fitting Company.
Neath and District Tramways Company.
Newport Electrical Engineering Company.

The following companies are to be struck off within three months unless cause is shown to the contrary:—

Aston Tube Works.
British Light Railway Development Syndicate.

Coventry Electric Tramways Company.—Norwich Electric Tramways Company.—At the statutory meetings of these companies, held last Friday at 4, Bank Buildings, E.C. (Baron E. Erlanger presiding), the following gentlemen were appointed the directors of both undertakings:—Baron Erlanger, Captain F. Pavy, Hon. Arthur Brand, Mr. E. A. Hopkins, Mr. T. M. Thackthwaite, and Mr. A. Von Cramm. Messrs. Deloitte, Dever, Griffiths & Co. were appointed the London auditors, and Mr. T. M. Pearson the local auditor for the Coventry Company.

Monte Video Telephone Company, Limited.—Warrants for a dividend of 4 per cent. for the year ended July 31st last, on the preference share capital, have been posted.

Chelsea Electricity Supply Company, Limited.—We learn that letters of allotment and regret for the new issue of ordinary shares have been posted.

TRAFFIC RECEIPTS.

The City and South London Railway Company. The receipts for the week ending October 24th, 1897, were £970; week ending October 25th, 1896, £1,003; decrease, £33; total receipts for half-year, 1897, £15,520; corresponding period, 1896, £15,695; decrease, £175.

The Liverpool Overhead Railway Company. The receipts for the week ending October 24th, 1897, amounted to £1,335; corresponding week last year, £1,092; increase, £243.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending October 15th, 1897, after deducting 17 per cent. of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £2,954.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present issue	NAME.	Stock or Share. ‡	Dividends for the last three years. 1894.	1895.	1896.	Closing Quotation, October 20th.	Closing Quotation, Oct. 27th.	Business done during week ended October 27th, 1897. Highest.	Lowest
149,900£	African Direct Teleg., Ltd., 4 % Deb.	100	4 %	4 %	...	101 —105	101 - 105	...	...
25,000	Amazon Telegraph, Limited, shares...	10	...	...	...	5½ — 6½	5½ — 6½	...	...
923,960£	Anglo-American Teleg., Ltd.	Stock	£2 2s.	£2 9s.	£2 13s.	58 — 60xd	57 — 59	...	...
3,038,020£	Do. do. 6 % Pref.	Stock	£4 4s.	£4 18s.	£5 6s.	104½ - 105½xd	104 - 105	106⅞	104½
3,038,920£	Do. do. Defd.	Stock	...	...	...	12⅜ — 13¼	12¼ — 12⅜	12⅜	12⅜
130,000	Brazilian Submarine Teleg., Ltd.	10	7 %	7 %	...	16 — 16½	16 — 16½	16⅜	16½
75,000£	Do. do. 5 %, Debs., 2nd series, 1905	100	5 %	5 %	...	114 - 118	114 - 118	...	...
44,000	Chili Telep., Ltd., Nos. 1 to 44,000	5	2½%	4 %	4 %	3¼ — 3⅜	3¼ — 3⅜	...	...
10,000,000$	Commercial Cable Co.	$100	7 %	7 %	7 %	178 - 183	178 - 183	...	...
653,586£	Do. Do. Sterling 500 year 4% Deb. Stock Red.	Stock	...	...	...	105 —107	105 —107	106¼	105⅞
224,850	Consolidated Teleg. Const. and Main., Ltd.	10/-	1½%	1½%	2 %	1/16 — 1/8	1/16 — 1/8	...	...
16,000	Cuba Teleg., Ltd.	10	8 %	8 %	8 %	8½ — 9½	8½ — 9½	9½	...
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	18½ — 19½	18½ — 19½	...	...
12,931	Direct Spanish Teleg., Ltd.	5	4 %	4 %	4 %	4 — 5	4 — 5	...	...
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 — 11	10 — 11	10 5/16	10 3/16
30,000£	Do. do. 4½ % Debs. Nos. 1 to 6,000	50	4½%	4½%	4½%	103 - 106%	103 —106 %	...	...
60,710	Direct United States Cable, Ltd.	20	2 %	2½%	2½%	10½ - 10⅝xd	10½ — 10⅝	...	...
400,000	Eastern Teleg., Ltd., Nos. 1 to 400,000	10	6½%	6½%	6½%	16⅝ — 17⅛xd	16⅝ — 17⅛	17⅛	16 15/16
70,000	Do. 6 % Cum. Pref.	10	6 %	6	6%	18 - 19 xd	18 — 19	18 1/16	...
89,900£	Do. 5 % Debs., repay. August, 1899	100	5 %	5 %	5%	101 - 104	101 - 104	...	...
1,302,615£	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4%	131 —134	132 —135	134	...
250,000	Eastern Extension, Australasia and China Teleg., Ltd.	10	7 %	7 %	7⅛	18 — 18½xd	18 — 18½	18⅜	18 1/16
35,500£	Do. 5 % (Aus. Gov. Sub.), Deb., 1900, red. ann. drgs. reg. 1 to 1,049, 3,976 to 4,326	100	5 %	5 %	5%	100 —104	100 104	...	...
133,100£	Do. do. Bearer, 1,050—3,975 and 4,327—6,400	100	5 %	5 %	5%	101 —104	101 - 104	...	...
320,000£	Do. 4 % Deb. Stock	Stock	4 %	4 %	4%	129 —132	131 —134	132	131½
51,100£	Eastern and South African Teleg., Ltd., 5 % Mort. Deb. 1900 redeem. ann. drgs., Reg. Nos. 1 to 2,343	100	5 %	5 %	5%	100 —104	100 —104	...	...
69,200£	Do. do. do. to bearer, 2,344 to 5,500	100	5 %	5 %	5%	101 —104	101 —104	...	...
300,000£	Do. 4 % Mort. Debs. Nos. 1 to 3,000, red. 1909	100	4 %	4 %	4%	103 —106	103 —106	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4%	109 —112%	109 —112 %	...	...
180,227	Globe Telegraph and Trust, Ltd.	10	4½%	4½%	4½%	11½ — 12	11½ — 12	11⅞	11⅝
180,042	Do. do. 6 % Pref.	10	6 %	6 %	6%	17½ — 17⅝	17½ — 17⅝	17½	17⅜
150,000	Great Northern Teleg. Company of Copenhagen	10	8⅝%	10 %	10⅜	26½ — 27½	26½ — 27½	27	26¾
160,000£	Do. do. do. 5 % Debs.	100	5 %	5 %	5%	102 —105	102 —105	...	...
17,000	Indo-European Teleg., Ltd.	25	10 %	10 %	10%	54 — 57	54 — 57	55	...
100,000£	London Platino-Brazilian Teleg., Ltd. 6 % Debs.	100	6 %	6 %	6%	107 —110	107 —110	...	...
28,000	Montevideo Telephone 6% Pref., Nos. 1 to 28,000	5	4 %	4 %	...	2 — 2⅛	2 — 2⅛	...	...
484,597	National Teleph., Ltd., 1 to 484,597	5	5 %	5⅛%	5⅛%	6⅜ — 6⅝	6⅜ — 6⅝	6 9/16	6⅜
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	15 — 17	15 — 17	...	...
15,000	Do 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	15 — 17	15 — 17	15½	15
119,234	Do. 5 % Non-cum. 3rd Pref., 1 to 119,234	5	5 %	5 %	5 %	6 — 6½	6 — 6½	6⅛	...
130,766	Do. do. Nos. 119,235 to 250,000, £3 paid	5	...	...	...	3¾ — 4¼	3¾ — 4¼	4⅛	...
1,329,471£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	104 —109	104 —109	106½	105¼
171,504	Oriental Teleph. & Elec., Ltd., Nos. 1 to 171,504, fully paid	1	4⅜%	5 %	5 %	9/16 — 11/16	9/16 - 11/16	...	...
100,000£	Pacific and European Tel., Ltd., 4 % Guar. Debs, 1 to 1,000	100	4 %	4 %	4 %	107 —110	107 110	...	...
11,839	Reuter's Ltd.	8	nil	5 %	5 %	7 — 8	7 — 8	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	135 —140	136 —141	...	...
58,000	United River Plate Teleph., Ltd.	5	3 %	4 %	...	3¾ — 4¼	3¾ — 4¼	...	...
146,733£	Do. do. 5 % Debs.	Stock	5 %	5 %	...	102 —107	102 -107	...	...
15,609	West African Teleg., Ltd., 7,501 to 23,109	10	nil	4 %	nil	5 — 6	4½ - 5½	...	...
213,400£	Do. do. do. 5 % Debs.	100	5 %	5 %	5 %	103 —106	103 - 106	...	...
64,256	Western and Brazilian Teleg., Ltd.	15	3 %	3 %	2 %	9¼ — 9¾	9¼ - 9¾	9½	...
33,129	Do. do. do. 5 % Pref. Ord.	7½	5 %	5 %	5 %	7½ — 8	7½ — 8	7 9/16	...
33,129	Do. do. do. Def. Ord.	7½	1 %	1 %	...	2¼ — 2⅜	2¼ - 2⅜	2⅜	2½
382,230	Do. do. do. 4 % Deb. Stock Red.	Stock	...	...	...	106 —109	106 —109	107	106¾
88,321	West India and Panama Teleg., Ltd.	10	⅛%	⅛%	1 %	⅜ — 1	⅜ — 1	1	...
34,563	Do. do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	9¾ — 10½	9¾ — 10½	10½	10
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	7 — 8	7 — 8	7¾	...
80,000£	Do. do. 5 % Debs. No. 1 to 1,800	100	5 %	5 %	5 %	107 —110	107 —110	...	...
1,163,000$	Western Union of U. S. Teleg., 7 % 1st Mort. Bonds	$1000	7 %	7 %	7%	106 —110	106 —110	...	...
160,100£	Do. do. 6 % Ster. Bonds.	100	6 %	6 %	6%	100 —105	100 —105	...	...

ELECTRICITY SUPPLY COMPANIES.

30,000	Charing Cross and Strand Electy. Supply	5	4½%	5 %	6 %	12 — 13	12 — 13	12	...
20,000	Do. do. do. do. 4½ % Cum. Pref.	5	...	...	...	6 — 6½	6 — 6½	6⅝	6¼
26,000	*Chelsea Electricity Supply, Ltd., Ord., Nos. 1 to 10,277	5	5 %	5 %	5 %	10¼ — 10⅜	10 — 10¼	10¼	10⅛
60,000	Do. do. do. 4½ % Deb. Stock Red.	Stock	...	4½%	4½%	110 —113	110 —113	...	...
40,000	City of London Elec. Lightg. Co., Ltd., Ord. 40,001—80,000	10	5 %	5 %	7 %	25 — 26	25 — 26	25⅜	25
10,000	Do. do. Prov. Certs.	5	...	...	...	24 — 25	24 — 25	...	...
40,000	Do. do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	17 — 18	17 — 18	17 1/16	17 1/16
400,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	5 %	5 %	5 %	131 —136	131 —136	...	...
22,475	County of Lond. & Brush Prov. E. Ltg. Ltd., Ord. 1—22,475	10	...	nil	nil	12⅜ — 13¼	12⅜ — 13¼	13⅛	12⅜
20,000	Do. do. do. 6% Pref., 40,001—60,000	10	...	6 %	6 %	15¼ — 15⅝	15¼ — 15⅝	15 1/16	15⅜
10,000	House-to-House Elec. Light Supply, Ord., 101 to 10,100	5	...	...	..	9 — 9½	9 — 9⅛	...	...
10,000	Do. do. 7 % Cum. Pref.	5	...	...	...	10¾ — 11¼	10¾ — 11¼	...	...
49,900	*Metropolitan Electric Supply, Ltd., 101 to 50,000	10	3 %	4 %	5 %	17½ - 18½xd	17⅛ — 18½	18	17 9/16
12,500	Do. Ord., 50,001—62,500, iss. at £2 prem.	10	...	...	...	17 — 18	17 — 18	17⅝	...
220,000£	Do. 4½% first mortgage debenture stock	...	4½%	4½%	4½%	119 —123	119 —123	...	...
6,452	Notting Hill Electric Lightg. Co., Ltd.	10	1 %	2 %	4 %	15 — 16	15 — 16	...	...
19,980	*St. James's & Pall Mall Elec. Light Co., Ltd., Ord., 101-20,080	5	6½%	7½%	10½%	16 — 17	16 — 17	16 7/16	16⅜
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	9½ - 10½	9½ — 10½	...	...
50,000	Do. do. 4 % Deb. stock Red.	Stock	...	...	...	103 —106	103 —106	...	...
43,341	South London Electricity Supply, Ord., £2 paid	5	...	...	...	1⅞ — 2¼	1⅞ — 2¼	2⅛	2
67,900	Westminster Electric Supply Corp., Ord., 101 to 68,000	5	5 %	7 %	9 %	14½ — 15½	14½ — 15½	14 9/16	...

* Subject to Founder's Shares. † Quotations on Liverpool Stock Exchange.

‡ Unless otherwise stated all shares are fully paid. § Dividends paid in deferred share warrants, profits being used as capital.

‖ Dividends marked ‖ are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL, COMPANIES.

Present Issue.	NAME.	Stock or Share ‡	Dividends for the last three years. 1894.	1895.	1896.	Closing Quotation, Oct. 20th.	Closing Quotation Oct. 27th.	Business done during week ended Oct. 27th, 1897. Highest	Lowest.
20,000	British Electric Traction	10	...	..	..	12¾ — 13¼	12¾ — 13¼	12 15/16	...
90,000	Brush Elecl. Enging. Co., Ord., 1 to 90,000...	5	2½%		...	1 — 1¼	1⅛ — 1⅜	1 5/16	1 3/16
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000	2	3 %	..	...	1⅝ — 2⅛	1⅝ — 2⅛	...	...
125,000£	Do. do. 4½ % Perp. Deb. Stock.... ...	Stock	4½%	..	..	105 —109	107 — 111	...	...
76,770	Do. do. 4½% 2nd Deb. Stock Red. ...	Stock	...	.	...	98 —102	98 —102	...	...
19,126	Central London Railway, Ord. Shares	10	..	..	....	9⅞ — 10¼	9⅞ — 10¼	...	.
143,103	Do. do. do. £6 paid	10	...	.	....	5½ — 6	5½ — 6	...	...
58,830	Do. do. Pref. half-shares £1 pd. ...	...	...	...	...	1 — 1⅛	1 — 1⅛	...	...
61,777	Do. do. Def. do. £5 pd. ...	...	...	...	...	4 — 4½	4 — 4½	...	...
630,000£	City and South London Railway	Stock	4⅛%	4⅛%	1 9/16%	69 — 71	69 — 71	71	70
28,180	Crompton & Co., Ltd., 7 % Cum. Pref. Shares, 1 to 28,180	5	*nil*	*nil*	.	1½ — 2	1½ 2	...	...
89,261	Edison & Swan United Elec. Lgt., Ltd., "A" shrs, £3 pd. 1 to 89,261	5	5 %	5 %	5½%	2¼ — 2⅜	2¼ — 2⅜	...	...
17,139	Do. do. do. "A" Shares 01—017,139	5	5 %	5 %	5½%	4 — 5	4 — 5	...	...
110,000	Electric Construction, Ltd., 1 to 110,000	2	*nil*	5 %	6 %	2 — 2¼	2 — 2¼	2 3/16	2 1/16
16,343	Do. do. 7 % Cum. Pref., 1 to 16,343 ...	2	7 %	7 %	7 %	3⅛ — 3⅜	3⅛ 3⅜	3⅛	3 5/16
91,195	Elmore's Patent Cop. Deposg., Ltd., 1 to 70,000	2	*nil*	...	...	⅜ — ⅝	¼ ½	...	...
67,275	Elmore's Wire Mfg., Ltd., 1 to 69,385, issued at 1 pm. ...	2	*nil*	...	...	¼ — ½	¼ ½	½	.
9,600£	Greenwood & Batley, Ltd., 7 % Cum. Pref., 1 to 9,600 ...	10	*nil*	10½%	..	9 — 11	9 11	...	...
12,500	Henley's (W. T.) Telegraph Works, Ltd., Ord.	10	6 %	8 %	10 %	19 — 20	19⅛ 20⅛	20¼	19⅝
3,000	Do. do. do. 7% Pref.	10	7 %	7 %	7 %	18½ — 19½	18⅛ 19⅛	...	...
50,000	Do. do. do. 4½ Mort. Deb. Stock	Stock	...	4½%	4½%	110 —115	110 — 115	...	...
50,000	India-Rubber, Gutta Percha and Teleg. Works, Ltd ...	10	10 %	10 %	10 %	21½ — 22½	21½ 22½	22⅛	...
300,000	Do. do. do. 4 % 1st Mort. Debs.	100	...	..	...	103 —107	103 —107	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	2⅝%	2⅝%	11¼ — 11⅝	11⅜ 11½	...	...
10,000	† Do. do. Pref., £10 paid	10	5 %	5 %	5 %	16 — 16½	16 — 16½	...	...
37,350	Telegraph Constn. and Maintce., Ltd.	12	20 %	15 %	15 %	36 — 39	36 — 39	38	36½
150,000	Do. do. do. 5 % Bonds, red. 1899	100	5 %	5 %	5 %	102 —105	102 —105	...	...
54,000£	Waterloo and City Railway, Nos. 1 to 54,000	10	...	...	...	12¾ — 13¼	12¾ — 13¼	...	...

Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ Last dividend paid was 50% for 1890.
Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.
Crompton & Co.—The dividends paid on the ordinary shares (which have not a Stock Exchange quotation), are as follows: 1892—0%; 1891—7%; 1896—8%.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

* Birmingham Electric Supply Company, Ordinary of £5 (£4 paid), 7⅞, £5 (fully paid) 9½.

Electric Construction Corporation, 6 % Debentures, 104—106.

House-to-House Company, 4½% Debentures of £100, 109—111.

* From Birmingham Share List.

Kensington and Knightsbridge Electric Lighting Company, Limited Ordinary Shares £5 (fully paid) 13½—14½; 1st Preference Cumulative 6 %, £5 (fully paid), 8—8½. Dividend, 1896, on Ordinary Shares 7 %.

London Electric Supply Corporation, £5 Ordinary, 2—2¼.

Yorkshire House-to-House Electricity Company, £5 Ordinary Shares fully paid, 8—8½. Dividend for 1896—6 %.

Bank rate of discount 2 per cent. (May 13th, 1897).

THE NEW YORK FIRE DEPARTMENT ELECTRICAL RULES.*

The new rules of the fire department of the City of New York, for the installation of electrical apparatus, for electric light, power and heat, just published, deserve more than passing comment. While the Fire Commissioners have adhered, in their latest rules, to the principles laid down in the National Electrical Code, their interpretations are probably more elaborate and their requirements more clearly defined than in any other publication of the kind which has come to our notice. This result was not entirely unexpected, however, as they gave evidence in their amendments of April 15, 1896, of what they intended to accomplish, before publishing a revision of the rules in their entirety. Many, if not all of the inconsistencies and ambiguities of the old rules have been eliminated, and although much new material has been introduced, the general effect is not so much productive of new methods of construction as it is of clear understanding of each requirement.

This is forcibly illustrated, for example, in Rule 3, relative to "Conductors from generators to switchboards, &c." Section A of the old rules required that such conductors be "In plain sight, on porcelain insulators, or easily accessible," and while it was, of course, impossible, in most metropolitan work, to comply with the first requirement, the second was so ambiguous as to cause much annoyance to engineers and contractors when they endeavoured to determine, without special consultation with the inspection authorities as to what would be acceptable to the spirit and letter of the law. The new rule covering this work leaves no room, however, for speculation. It provides for five distinct methods of doing the work, with prescribed requirements for each, and whichever style is adopted, a high standard of safety will be the result.

Section A, of Rule 4, is a decided novelty, inasmuch as it is the first rule, published in this city, which makes compulsory the provision of a switchboard for each isolated plant, and while it is true that most of the modern plants are provided with switchboards, it must be admitted that heretofore they have been the result of engineering expediency and not of any law compelling their use. The necessity of a suitable switchboard in connection with an electric plant, as a safeguard against fire and personal injury will be unquestioned by all authorities on the subject, therefore the new rule is most timely, and as much as any of the others, indicates the thoroughness with which the work has been accomplished.

In Rule 13, Section D, we find that enclosed arc lamps are very properly exempt from the requirement of globe nets, which are never ornamental, and on this type of lamp are of little or no value. Rule 14 settles definitely the vexed question of service entrance, which should unquestionably be at the front of buildings, in order that it may be readily found, in case of emergency, by firemen or others requiring access to it. The allowance of the tee-service connection to the buildings on either side of that entered from the subway is well within the limits of safety, while sufficiently liberal to be much appreciated by the lighting companies.

We note that Section B, of Rule 22, prohibits the use of brass armoured conduit, which, on account of its fragile nature, has no place in the high standard of construction of the present day, although it is undoubtedly entitled to the credit of being the first insulated armoured conduit, and is probably more than any other product of its kind, responsible for the high class iron armoured conduits at present on the market. Sections E, F, G, and H, of this rule, make ample

* New York *Electrical Engineer*.

provision for the safe use of flexible conduits, which are absolutely necessary in the wiring of some completed buildings. Section M very wisely prohibits the use of any conduit having an interior diameter smaller than seven-sixteenths of an inch, thus removing all the trouble hitherto experienced in the drawing in of conductors (often an impossibility) in $\frac{3}{8}$-inch conduit having three or four bends in a section.

Rule 23, applying to cut-outs, is most elaborate and, like the others, thorough in every detail. Section B of this rule allows 10 amperes as the greatest amount of current to be dependent upon one fuse, thus eliminating the old inconsistency of placing the limit at six 16 C.P. lamps (three or six amperes), for one class of work, and allowing from ten or more amperes on other groups of lamps that might be on the same main circuit.

Rule 25, in the shape in which it appears, fills a long felt want among engineers and construction men, in providing them with tables, showing in Section A the amount of current that may be safely carried on conductors of any size, from No. 18 B. & S. to 2,000,000 cir. mils; while Section B indicates at a glance the distance required between conductors of opposite polarity, and Section C gives an elaborate table, showing the insulation resistance required on any circuit carrying from 10 to 6,000 amperes and operating with an electromotive force of from 50 to 500 volts.

These are an excellent set of tables and will be welcomed by every one working under the rules, but we believe the allowances of Section A might be a little more liberal without increasing the fire hazard, and we have no doubt that the Fire Commissioners will remedy this if it is brought to their attention.

Rule 28 removes the old absurdity of requiring that all arc lamps be supplied with current by conductors not smaller than No. 12 B. and S., a good rule when it was first adopted, but one that, until now, was persistently printed in all rules for years after it had outlived its usefulness, although it was seldom, if ever, enforced.

Rule 31 is another innovation, permitting, as it does, work that has always been done wherever electric current could be obtained, although it has been in violation of all rules published year after year prohibiting the use of incandescent lamps in series.

The new rules are in many ways a creditable production, and while they may, and probably will, give rise to controversy on some points, we believe that they will meet with general approval among electrical engineers as well as contractors. The adherence of the Fire Department to the principles embodied in the National Electrical Code shows not only sound sense on their part, but an appreciation of the fact that the National Code embodies all that is necessary to cover any kind of electrical construction and needs only to be amended from time to time to keep step with the advancement of the art.

WHAT NIAGARA CAN DO.

In the *Western Electrician* we notice a reprint of a very interesting address, lecture or paper, lately given by Mr. C. F. Scott before the Engineers' Club of Philadelphia: and some of the matter therein contained is worth reproducing here, particularly the brief account (illustrated by a diagram) of the various special uses to which power from Niagara has been put.

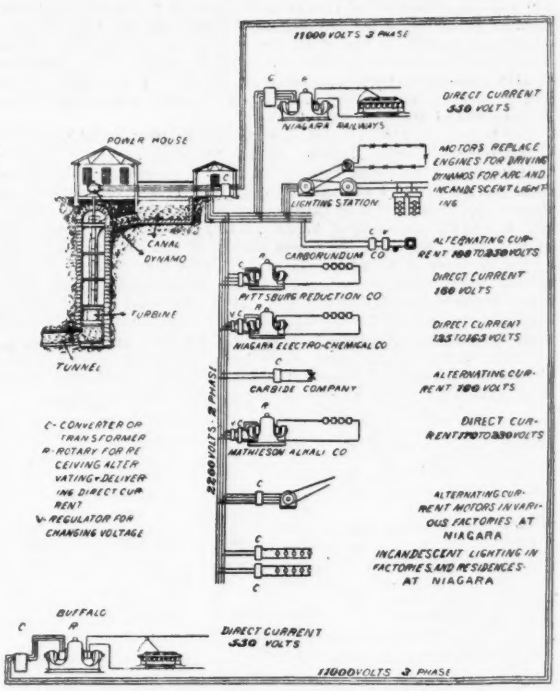
The amount of power available from the Falls has often been estimated and stated, but Mr. Scott thinks that the mere mention of "6 or 7 million horse-power" conveys no very definite idea; and therefore he gives the familiar illustration of what would be required in the shape of plant or human energy to pump the water back again. If, he says, a man exerts a force of about 20 lbs. per stroke, and works at a fair rate for eight hours a day, it would take about 10 times the total population of the United States to pump the water back as fast as it is flowing over the Falls.

Dealing with the various uses to which Niagara power has been applied electrically, he enters upon some interesting, but rather complicated, mechanical analogies to illustrate two and three-phase systems, but it is unnecessary to follow him in this direction, and is better worth while to summarise the electrical industries in the neighbourhood of the Falls which rely upon them for power.

The first commercial use of power from Niagara was by the *Pittsburg Reduction Company* in its extensive works on the river a short distance above the power house, for the manufacture of aluminium. The current is reduced in pressure from 2,200 volts to a low voltage, and is supplied to machines for transforming the alternating current into direct current. These machines perform the double function of operating as alternating current motors and as direct current generators. The machines are similar in general to direct current dynamos, with the addition, however, of collector rings for receiving the alternating current and introducing it at suitable points in the armature winding. A mechanical analogue is found in the shaft of an engine which receives power by two cranks from reciprocating rods and delivers it to a belt running in a constant direction. This plant has a capacity of nearly 4,000 horse-power, which is used in the form of direct current at about 160 volts for the manufacture of aluminium by the Hall process.

In the works of the *Carborundum Company* a large transformer and a regulator are installed which deliver 1,000 horse-power of alternating current to electric furnaces for making carborundum, the new abrasive, whose hardness is exceeded only by that of the diamond. The suitable materials, salt, glass-sand, sawdust and coke, for making the carborundum are placed in a furnace built of loose bricks and the current is passed through from one end to the other. The passage of the current produces heat throughout the interior and raises the temperature to a very high degree. The resistance changes during the process, requiring an adjustment of the current in order to maintain a constant supply of energy. This necessitates a change in pressure from about 250 to 100 volts. After about 24 hours a compound of silicon and carbon is formed, the amorphous central core being surrounded by beautiful crystal.

The *Acetylene Light, Heat and Power Company* manufactures calcium carbide by the union of lime and coke in the presence of an intense heat generated by the electric arc. The current passes



DIVERSIFIED USES OF ELECTRICAL POWER AT NIAGARA.

between two enormous terminals or electrodes which are separated by several inches, and the arc through this space radiates an intense heat. The powdered materials surround this arc. The arc gives an intense light and a loud humming sound having a frequency corresponding to that of the alternations of current. This company has operated with a 1,000 horse-power transformer which reduces the pressure to 100 volts. It is now installing several more transformers of the same size.

The *Niagara Electro-chemical Company* uses about 500 horse-power in direct current for the manufacture of metallic sodium by the Castner process. The current is delivered at a voltage which may be varied from 125 to 165 volts by means of a regulator connected with the lowering transformers. The number of turns in one of the winding of these transformers may be varied at will, thus changing the ratio between the number of turns in the two windings and thereby raising or lowering the resultant pressure, which in turn varies the pressure delivered by the machine which supplies direct current. One of these machines differs from the others in having no field coils. The magnetising effect, which is usually secured by direct current through the field winding, is here obtained from the alternating current through the armature winding.

The *Mathieson Alkali Company* is now installing a plant in which about 1,500 horse-power will be used in the form of direct current at a voltage variable from about 175 to 225 volts.

The *electric light plant* for the village of Niagara Falls has in addition to its former steam plant two 400 horse-power induction motors which receive power from the Niagara generators and are used for driving the dynamos which supply the commercial lighting circuits. Much of this lighting might be supplied directly by the circuits from the large generators, but a part, notably the arc lighting, cannot be thus supplied, and the motors were introduced as a simple

mechanical arrangement for furnishing power to the existing plant. The induction motor possesses many advantages over its rival, the direct current motor, not only as regards electrical performance, but especially in its mechanical characteristics. As is well known, the commutator in direct-current machinery is the element which is most difficult to construct and which is the part most liable to accident and deterioration and wear, and which calls for care and skill in attendance. This feature is entirely absent from the induction motor, which in its most approved type has no open or moving electric contacts whatever. The revolving element is ideally simple. It consists of an iron core with holes near the circumference, through which are placed copper rods which are securely bolted to rings at each end. The currents in this element are induced through magnetic action from the currents in the coils on the outer stationary part of the machine which are received from the supply circuit. The induction motor tends to run at a certain definite speed and falls off a trifling amount from this speed as it is loaded. The synchronous alternating current motor must run at a perfectly definite speed, and when the speed falls below this amount, caused by overload or otherwise, the motor will stop. It is much more sensitive in its operation and requires closer adjustment and attention, both mechanically and electrically, than the flexible induction motor.

Mechanical power is supplied from Niagara circuits for various minor operations, such as driving fans, pumps, crushers, etc., in connection with the various establishments which have already been described.

The only present use of mechanical power on a large scale is in the operation of *street railways*. Direct current at a pressure of about 500 volts is obtained for this purpose through the agency of transformers for reducing the pressure of the main circuits and rotaries, which are similar to the machines at the various chemical works which receive alternating and deliver direct current. Three machines of 500 horse-power each are located in one end of the power house and supply current to the railways in Niagara Falls and to the Niagara end of the road to Buffalo.

The feature, however, which attracts the greatest popular interest is the *transmission to Buffalo*. In the transformer house are two transformers, with a total capacity of 2,500 horse-power, which transform the 2,200 volt two-phase current into 11,000 volt three-phase current, which is carried by three heavy copper cables on a substantial pole line to the outskirts of Buffalo, where it passes into cables in an underground conduit to the power station of the city railway plant, a total distance of 27 miles. Here the current is reduced in pressure, is transformed into direct current and supplies about 1,000 horse-power to the trolley circuits. It is proposed to increase the transmission voltage to 22,000 volts and supply power on a large scale for general purposes as soon as the apparatus can be installed.

These various special uses of Niagara power are shown pretty clearly in the annexed diagram; but it will help our readers to see what has been done if we also tabularise them as follows:—

Purpose for which current is used.	Form of current used.	Voltage or pressure at which used.	H.P. required.
Aluminium works ...	Direct	160	4,000
Carborundum „ ...	Alternating	100—250	1,000
Calcium carbide works ...	„	100	1,000
Sodium „ ...	Direct	125—165	500
Alkali „ ...	„	175—225	1,500
Electric lighting ...	Alternating and direct	Various	800
Street railways	Direct	550	1,500

It will be remembered that two-phase current is generated in the main power house at a pressure of 2,200 volts.

THE PROTECTION OF TELEPHONE INSTRUMENTS FROM LIGHTNING.

We illustrate below a new device which has been designed by the Western Electric Company, of Coleman Street, E.C., for the protection of subscribers' telephone instruments against lightning and other currents of abnormal strength.

Fig. 1 shows the protector complete. It is mounted upon a porcelain base, and comprises everything necessary for the protection of a metallic circuit instrument. The essential parts are:

A carbon plate lightning arrester, with air space and globule of low melting alloy;
Two fibre tubes with fuses; and
Two heating coils.

Each part has been so designed that it can be replaced easily in case of injury.

Very strong currents break the circuit by melting the fuse wire, or go to earth across the air space of the arrester; currents of less strength act upon the heating coil.

Fig. 2 shows the carbon plate arrester, which consists of two rectangular blocks of carbon, C, having two flat surfaces between which a definite separation is maintained by means of a U-shaped mica separator, N. The thickness of the mica determines the sensitiveness of the device. The proper thickness for protection against currents of 350 volts is 14/100 m/m (0·0055 inch). Carbon plates are used because they do not become welded together by brief discharges, and also because, for a given voltage, the separation between them may be greater than with metallic plates. The open portion of the U-shaped mica separator should always be directed downwards in order that dust may not collect between the plates. The carbon

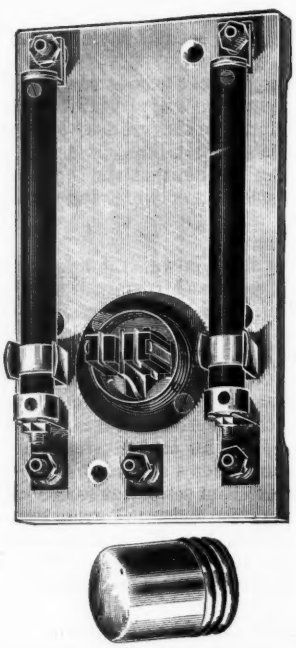
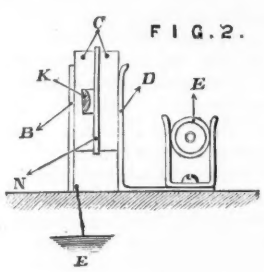


Fig 1.

plates are clamped between the two springs, B and D, one of which is connected to earth, and the other to the metal ring, E, of the tube which contains the fuse wire. One of the carbon plates is made with a slight cavity in its sparking surface, and a small globule, K, of low melting alloy is placed in this cavity. When a sudden discharge occurs, the device operates in the same manner as an ordinary lightning arrester; that is to say, an arc is formed between the two

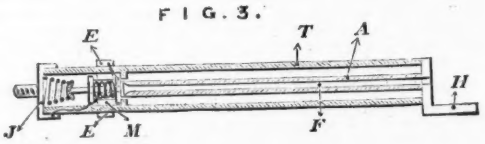
FIG. 2.



carbon plates. If the discharge is prolonged, the globule of low melting alloy fuses and, flowing between the plates, puts the line to earth, extinguishing the arc. When this happens it is necessary to renew the carbon plates.

Fig. 3 shows the tube with fuse. This tube, T, is made of vulcanised fibre and contains a fuse wire, F, made of a special alloy and surrounded with an asbestos braiding, A. The asbestos prevents sparking. The diameter of the wire is such that it fuses with a current of 5 amperes. One end of the tube is provided with a

FIG. 3.

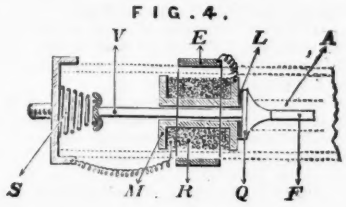


terminal, H, for connection to the line binding post. Near the other end is the metal ring, E E, set in the clamp from which earth connection is made through the arrester. At the extremity of the tube is another terminal, J, from which connection is made to the subscribers' apparatus. Between the metal ring, E E, and the terminal, J, is placed the heating coil, M.

The heating coil is shown in fig. 4. Around a small metal tube, M, is wound 27 ohms of German silver wire, R. Within the tube is a glass pin, V, which is pressed against the disc, Q, by a spiral spring, S.

The disc, Q, is soldered with a low melting alloy, L, on one side, to the metal tube, M, of the coil, and on the other side, to the fuse wire, F, before described. A strong current passing through the German silver wire, heats the tube, melts the alloy, and so releases the disc soldered to the tube, L. The disc, Q, is thus forced back by the glass pin, V, which is acted upon by the spring, S. The connection of the

FIG. 4.



fuse, F, with the heating coil and the arrester is severed, and the line is automatically broken. This protector is the result of years of experiment and practical test by the American Bell Telephone Company, and it is the only one which efficiently protects subscribers' apparatus against all currents of abnormal strength. Its weight is 35 oz., and it measures 7¼ × 4 inches.

GLASGOW TELEPHONE INQUIRY.

(*Continued from page* 558.)

NINTH DAY'S EVIDENCE.

THE case for the National Telephone Company was continued.

MR. WILLIAM EDWARD L. GAINE, the general manager of the National Telephone Company, was further cross-examined by MR. URE Witness said that the average number of faults in Glasgow in one year was 3·02, which gave 19,650 out of 12,000,000 messages. He could not say how many of the faults were incident to the single wire system as compared with the twin wire underground system. He had not attempted to discriminate between them, because he did not think it important. The design of the table he had submitted was to show that the number of faults were infinitesimally small upon the vast volume of business that was going through—faults due to plant. Many of the complaints in Glasgow were not due to line faults at all. If a line was in order there might still be induction upon it.

You said yesterday that the overhead double wire system was ineffective and expensive?—I said inefficient.

Does your table support that view?—I don't think the table has any relation to the question at all.

If you find in Glasgow five or six times the number of faults as compared with other large cities with the same system, do you still say that you find no room for improvement in Glasgow if your are not allowed to adopt the double wire underground system?—First of all I must take exception to your premise. If you look at the return you will find other large cities with an equally large number. Liverpool has even a greater number. You may get out a table showing faults year after year, and you will find that it varies every time. It is the habit of people in some places to complain more, and in others to complain less. Many of the faults are of an extremely simple character. If the subscribers are exigeant, they are in the habit of complaining about every little fault, and in consequence you have a great number of faults indeed. If there are not the line may go on speaking reasonably well, and no complaint will be made, and that fault, whatever it may be, may not be put right for some little time. I can't see that there is any conclusion to be drawn from these figures as to whether a single overhead system is a good system as compared with any other system.

How do you account for Glasgow being at the top of the list in 1894, and also in 1897, in regard to faults?—I have no explanation to give. As I said before, the proportion over the business is infinitesimally small.

How do you account for Birmingham in 1897, when it had a double-wire system underground, having a larger number of faults than Birmingham in 1894 with a single wire overhead system?—I can't really account for it. The return includes all the faults, whatever they may be; switchboard faults, for instance, which are inherent to the telephone system. There are many faults which would not occur with an underground twin-wire system. For instance, there are induction and contact faults. You can't have a storm in Glasgow without having a number of these faults brought on.

How is it that in Newcastle, with a twin-wire system underground, you have decimal 6 of complaints or faults with 3,555 messages per subscribers' line, and in Middlesbrough, with a single-wire overhead system, you have decimal 54 with 4,403?—There is no explanation.

Now that your attention has been drawn to the condition of the system in Glasgow, do you still say you are going to make no effort whatever to improve the service in Glasgow if you are refused access to the streets to lay a twin-wire underground system?—I don't say so.

THE COMMISSIONER: He is not the board of directors of the company.

MR. URE: Imagine, for a moment, that there was competing against you in Glasgow a single-wire overhead system, do you say you would improve your present system consistent with the retention of the single-wire system?—I can't answer such a question; I am not the board of directors.

But I thought you were representing them. Shall we see some of the directors?—I don't know.

Will you tell me whether it is the fact that, with a single overhead wire system, you have beaten the Post Office with an underground twin-wire system in several towns?—We have in several towns exchanges, and may I put it that it is by the energy displayed by the company they have prospered so well.

Would you undertake now to beat an underground double-wire system with an overhead single-wire system with efficient management?—You ask me a very difficult question. I can't undertake anything of the kind.

Did you manage your system in the towns in which you beat the Post Office in the way in which you manage your system in Glasgow?—Yes. Still, I think your clients would be very much more satisfied to have a metallic circuit underground system rather than what they have at present.

Questions by MR. URE as to the amount of money expended by the company upon plant and apparatus in Glasgow, and in securing a monopoly and buying up other companies, were objected to by MR. ASHER.

THE COMMISSIONER sustained the objection.

MR. URE: Supposing that your company paid 6 per cent. upon the capital expenditure in establishing the service in Glasgow, can you tell us what would be the charge per subscriber as contrasted with the charge which you now make?

MR. ASHER objected, and the objection was sustained.

MR. SALVESEN: The position of your company is unique in respect of it having an unrestricted monopoly?—I don't agree with you.

So long as the Postmaster-General refuses licenses to competing parties, have you not an unrestricted monopoly?—No.

In what way is it restricted?—The Post Office is in competition, and retains an absolutely free hand to compete if they choose. The company is the sole body in Glasgow and in Scotland carrying on the service at the moment.

Your object in leading evidence in this inquiry is to prevent the Corporation obtaining such a license?—My object is to show how unreasonable the authorities have been in refusing us facilities to do that which we ought to do, and to defend the position as it stands.

MR. SALVESEN quoted an answer given by Mr. Forbes, the president of the company, before the Parliamentary Committee, in which he said that he should like to see experimentally what a big corporation would do in competition with the National Company on even terms, and asked if the company's position now was not a change of front?—WITNESS suggested that Mr. Forbes's answer was ironical.

Dear, me! He undertook to keep the business even if he had a big corporation against him, and would welcome a corporation coming in that he might put them to the test; is not that what he says?—I think he intends to say that he would be very sorry for the corporation at the finish.

Your view of the Act of 1892 is that once consent has been got allowing wires under the street, in any subsequent differences that might arise between the municipality and yourself, the municipality have no absolute discretion as to what is to be done?—If the municipality is the street authority, that would be so.

You know that it is so in Glasgow?—Yes.

So that if the Glasgow Corporation gave consent to your laying wires under the street, they would part with their control of the streets so far as you are concerned?—If they were to give consent without conditions that would be so. But I refer you to the Liverpool agreement, where that point is expressly provided for. Witness, continuing, said that he could not conceive of such a monstrous proposal being agreed to as that the Corporation should get a license putting it upon differential and better terms than the company.

You consider it monstrous that the Corporation should have the right of putting pipes under its own streets without conceding the same facilities to a competing company?—No; but it is monstrous that the Corporation of Glasgow should be employed as an agent of the State, in competition with another agent of the State, and upon better terms.

Do you say that a license would be of no avail to the Corporation of Glasgow?—I say they would find that they would have to go to Parliament.

For leave to lay pipes in their own streets?—No, not necessarily; but I think they would find it necessary to obtain Parliamentary power to take up the streets of other portions of the area; I think they would have to take Parliamentary powers for many purposes connected with the service.

Is it your position that the advantage Glasgow has of going under the streets is so great that it will be monstrously unfair if it were allowed to go into competition with you?—Yes, more particularly having regard to the fact that Parliament has placed Glasgow Corporation in the position of being the consenting party to a company as agent of the State during its work, and it is because they refuse to give that consent, and there is no appeal from it, that they are in a position here that would be monstrously unjust.

The advantage to Glasgow would be so great, that the competition would annihilate your exchange?—That is problematical; I cannot answer. I don't think we should be wiped out.

Is not that what you fear?—No.

Is not that why you say it would be monstrously unfair?—I say it would be unfair to the company, and I think it would be a great disadvantage to the people of Glasgow.

If it be the case that Glasgow could supply a cheaper and better service at half rates with the advantages it enjoys, do you see any unreasonableness in its forfeiting that privilege in favour of a private company such as yours?—First of all, I cannot accept your premise.

But I ask you to accept the premise?—I still hold the position, and for this reason. If you take the history of the way these questions have been dealt with by Parliament, you find that when there has been any question of a competing company seeking powers, or any body seeking powers to compete, Parliament has not permitted competition simply because one company says: "We might be able to do this at a trifle less, because we are now in possession of all you people have taught us, and we can therefore put down a cheaper plant and do it a trifle cheaper." I don't think competition has ever been allowed provided the existing company has been giving a reasonable service at a reasonable price.

Replying further to Mr. Salvesen, Witness said that the exercise by the Corporation of their powers to provide electric tramways would seriously affect the present telephone system in the city. There was no doubt that it would render the present system practically useless unless the Corporation acted as reasonable men, and gave reasonable facilities to the company to do its work.

You made no application for leave to lay underground wires until your protective clauses against the Corporation in connection with electric tramway traction had expired?—I have never paid any regard to protective clauses. They have been worth nothing.

Is not your position in Glasgow that so long as you are refused consent to go underground, the Corporation, by the construction of works for which they have obtained Parliamentary sanction, can make your telephone system useless?—They could do so. We might in that event have to spend a great sum of money to do overhead what we could do very much better underground. But I can't see that the Corporation would be so unreasonable as to use that advantage.

At present they appear to be masters of the situation?—They are masters of the situation to this extent, that they may force this company to spend a large sum of money in putting up an overhead system which would not be so good as an underground one—a larger sum than would be necessary to expend on an underground system.

Mr. Salvesen: The table showing the number of calls in Glasgow, which you put in yesterday, shows both calls and answers?—That is explained on the table.

The Commissioner: This reminds one of the Shorter Catechism, there is so much about effectual calling in it. (Laughter.)

Mr. Salvesen: What provision do you think it necessary to make for the repayment of capital when your license expires in 1911?—I can't answer that question.

Do you not know that you could compel an arrangement with any Government before the expiry of your license?—No, Mr. Salvesen, the question is far beyond my comprehension.

Do you in your rates include a sum for repayment of capital?

Mr. Asher (interrupting): That is again going into the details of our business.

The Commissioner: I think so.

The question was not allowed.

Continuing his evidence, witness said that so far as working expenses were concerned Mr. Bennett's estimate of the cost of a telephone service in Glasgow was nonsense.

Mr. Salvesen, showing witness a balance sheet and statement of accounts as published to the shareholders of the National Telephone Company, asked him if it was possible from it to find out the cost of maintenance per line.

Mr. Asher again interposed, and objected on the ground that it was a renewed attempt to obtain details of their business, a course on which the Commissioner had already given a ruling.

Mr. Salvesen pointed out that the witness had characterised Mr. Bennett's estimate as nonsense. What he wanted to do was to prove from the company's own calculations that it was not nonsense.

The Commissioner said he was not going into the question of the profit and loss of the company. If he wished to do that he would employ an accountant and set him to examine for him, and overhaul the books of the company to let him know what they had made out of Glasgow, and things of that sort. He did not think he had any business to do that however, and he was not going to allow anything which was incompetent to be done in that haphazard way.

Witness, continuing, said that the Corporation of Glasgow had given the company very great facilities in regard to wayleaves. The relations between them had always been most amicable, and he hoped they would continue to be so. The Corporation had a very large system of telephones served by the company, and he was astonished that no officer of the Corporation had been brought forward to give evidence as to the nature of the service. His view was that it was thoroughly efficient and satisfactory to them.

Mr. Salvesen: It is entirely open to you to prove that by calling an officer.

Dr. John Hopkinson, F.R.S., was the next witness. Replying to Mr. Asher, he stated that he had had large experience in electric matters. He had examined the Glasgow telephone system. There were certain defects inherent in, and inseparable from, such a system. Not only were the voices speaking upon the line heard, but the voices of other people upon other lines and other call bells were heard; there were also other sounds due to other causes of electrical disturbance, such as the lighting system on the underground railway. They could hear trains passing on the line whenever they listened upon the telephone wire. That arose from the fact that the trains were lighted electrically. These sounds were transmitted largely by induction, and partly by the fact that they had a common return by earth for all their circuits. As an overhead system, so far as efficiency was concerned, the present system was exceedingly well constructed, and the disturbances were not greater than those he should expect to find on a very large scale such as they had in Glasgow. In his opinion, the proper cure for the defects at present incident to the Glasgow system was metallic return and the wire laid underground.

Would you recommend overhead conductors and metallic returns?: No; for this reason. Overhead conductors, as they at present exist, are a very serious nuisance. You would have an increase of overhead wires. They are bad already, and if you were to make them worse, they would become intolerable. He went on to say that, in the interest of the community, there should be an underground metallic system.

By Mr. Salvesen: There could be a much better system in Glasgow on a metallic circuit than the present one. It was very difficult, without a metallic circuit, to get rid of the disturbance caused by the electric lighting of the underground railway trains. If the Corporation adopted overhead electric traction for the tramways, it would have an effect similar to that of the lighting of the trains, but possibly in a greater measure. It would depend, however, on the character of the contacts.

The system being pretty bad at present, would it be disastrous to the overhead wire system?: I can't say it would be disastrous or not. It would make it worse, undoubtedly. There is no mode of providing against that except by duplicating the wires overhead or underground.

Mr. William Edward Langdon, electrical engineer, and member of the Council of the Institution of Electrical Engineers, with 40 years' experience of telegraphy, corroborated Dr. Hopkinson's evidence.

Mr. Dane Sinclair, engineer-in-chief to the National Telephone Company, replying to Mr. Asher, stated that he had had experience of the telephone both at home and in Japan. Improvements had been made in the service in Glasgow from time to time.

As the result of your experience, what is the best kind of system for a telephone system?—So far as the outside portion of it is concerned, I don't think there is really any but one opinion among all people who have to deal with this question, and that is that the best system is a complete metallic circuit with the wires laid underground in lead-covered cables, and placed in conduits under the streets. That would largely tend to do away with the faults complained of. The constant shifting of wires through the withdrawal of wayleaves would also be done away with. Witness then submitted a statement showing the number of faults which had occurred in Glasgow in three years through building operations. There were 9,074 faults from that cause; withdrawals of wayleaves, 4,977; improvement of routes, 3,954; fires, 262; storms, 700; and sundries, 457—in all, 19,524 faults from these causes. He thought that too much had been made about the effect of storms, and his statement proved this fact.

The Commission then adjourned for luncheon.

On resuming,

Mr. Sinclair, replying to Mr. Asher, explained that the complaints as to numbers being engaged were frequently due to subscribers' neglect to call off. He further explained in detail the arrangements in the exchange for dealing with such complaints, and for effecting connections with the least possible delay. The call wire was provided merely to enable subscribers to ask for connections, and if it was properly used many of the complaints would be entirely removed. Among the principal causes of disturbance in Glasgow, were noises coming from electric lighting of the trains in the underground railway. Induction and contact were also causes. Along with witness, Lord Kelvin some years ago spent several evenings in the underground railway endeavouring to solve that question, and it was shown quite clearly that the noises were due to the electrical arrangements for lighting the trains. An operator could not give a preferential service to one subscriber over another, because she had not the option of making a selection. A record could be kept of the order of calls, so as to give connections according to priority of turn, but not with the switchboard work. For long trunk line business it was, in fact, actually done, but if they asked an operator to add that to her other duties, the result, he thought, would be worse than at present. In other words, the company expected the subscriber to call the operator, get what he wanted if the number was clear, but they did not regard it as their duty to provide operators to go back to the subscriber and find out when his friend was disengaged or had, perhaps, returned from his lunch. It would be a serious duty to put on an operator who had to make a large number of connections in a very short space of time.

The Commissioner: And would keep her off her proper work?—That is so. When in Stockholm he found that the Government service was better than that of the Telephone Company, and was quicker, but there were very sufficient reasons for that. More telephone service was done on Sunday in Sweden than in this country. In consequence of the competition in Stockholm, about 2,000 subscribers were obliged to go on the two systems. That, he thought, was one of the great objections to competition.

The Commissioner: Your general criticism on Mr. Bennett's plan is that it is drawn on a fancy idea, and would not suit for the number of subscribers who are on the exchange at present?—His scheme would not work at all. There is not enough cable provided.

By Mr. Asher: There was a deficiency in the estimate of 323 junction wires. He had looked at the tenders which had been sent in in connection with Mr. Bennett's estimate, and he found that there was a stipulation that they must be accepted within one month from September 28.

There is not much chance of that, I suppose?

Mr. Ure: It is the case that you beat the Post Office in certain towns with an overhead system, while they had an underground system?—It is right to explain that the underground wires in those days were not so good as the underground wires which can now be laid. They obviated induction, however.

Do you think that if you had a competitor in Glasgow, you could beat them now?—Oh! opinions are——

You think you could?—(No answer.)

Mr. Salvesen: In eight years you have done nothing to obviate the disturbance caused by the electric lighting of underground railway trains?—No.

Although it could have been done at some expense?—I don't agree with that. There is the way of putting in a metallic circuit.

Or putting in a part that way?—Then you are in other trouble, because you cannot work a part on the switchboards. Witness said that one fault of the single-wire system was that it prevented the use of the best form of transmitter. There was not, however, very much in it. On the whole, the balance of advantage was in favour of retaining the Blake transmitter. Reverting to Mr. Bennett's estimate, he said that if he were to put down an underground system in Glasgow, he would provide 40 miles of cable, while Mr. Bennett had only provided for 22 miles.

The Court adjourned to resume next morning at a quarter-past 10 o'clock.

Tenth Day's Evidence.

Mr. Dane Sinclair was further cross-examined by Mr. Salvesen. He said that, given a £5 rate, it was likely that there would be more subscribers in outlying districts, such as Langside and Partrick, than the company have on their list at present.

By Mr. Asher: When providing a new underground telephone system, it was the practice to put down square tubes equal to three times the immediate requirements, and wires to twice the requirements. If that were not done, they would have to open up the streets at an enormous expenditure of capital, and great disturbance to the public.

Lord Overtoun, replying to Mr. Asher, said that he had to use the telephone in connection with his business for 15 or 18 years. He had two in West George Street, and one at his works in Rutherglen. He had had two instruments during the whole time, and a third for two or three years. He found the telephone a great convenience in the conduct of his business. In communicating with subscribers he expected to find them engaged. He had found men engaged for a longer time than he thought was warranted. He attributed this to two things—partly to carelessness on the part of the subscriber, and partly to the carelessness of the operator.

Would it be correct to describe the telephone as a nuisance?—The language is somewhat strong. I have read the evidence on the subject. Some of it has been somewhat exaggerated.

Has the service appeared to be as good as you would expect?—We were led to expect perfection when the telephone company was introduced, and that has not been attained. Possibly it would be unreasonable to expect perfection.

Do you see any reason why the Corporation should not give the telephone company means of having an underground circuit?—I see nothing to prevent it.

Are you in favour of the Corporation securing the telephone business themselves?—Certainly not. I do not think two telephone systems in Glasgow would be a desirable thing; it would be very much the reverse. If two existed it would necessitate subscribers being on both. An efficient service under one body would be preferable.

Mr. Ure: You have disclaimed the description of the telephone system as a nuisance. Might it be described as expensive and unsatisfactory?—I believe in many respects that is so. He had frequently complained of inefficient service and of delay in getting connection, apparently owing to there being too many subscribers on one wire, of noise and indistinctness, and that he was rung off before a conversation was finished.

Do you consider the charge made by the company as reasonable?—No. Naturally one wants to get telephonic communication as cheaply as possible, especially when you know that elsewhere rates are lower.

Mr. Asher: Do you consider that a municipal exchange would give the subscribers adequate facilities?—Certainly not; it would be convenient enough for those in the town, but not for the net-work over the country which exists at present.

Mr. Salvesen: May I ask if you have been assuming that a municipal exchange could not give connection with places elsewhere?—I am not assuming that at all. The handing over of the trunk wires to the Government has caused a fresh communication to be made every time, which has resulted in delay, and that is the objection to there being more than one great company over the country.

Then, if it is bad with two authorities, it would be worse with three?—It would be still further aggravated.

The Commissioner: You have said that you are not in favour of the municipality getting a license. Will you tell us why?—Well, first, it would aggravate the present evil. With all deference, I think the Corporation have plenty on hand already without undertaking the telephone service. In the next place, it seems to me that the objections to lifting the streets does not come to very much after all, because I believe the Telephone Company, in their suggestions and proposals, state that they are willing to leave the matter in the hands of the municipality. Then, I question very much whether the proposal to give the service for £5, which has tempted many people to give their support to the municipality getting a license, is well founded. Stockholm has been instanced *ad nauseam*, but it must be remembered that it is isolated, and is not connected with a net-work of wires all over the country as is the case here.

Paul Rottenberg, senior partner of Messrs. Leisler, Bock & Co., and chairman of the Chamber of Commerce, replying to Mr. Scott Dickson, said he had had extensive experience of the telephone in this country and on the Continent.

What do you say of the Glasgow service as compared with the experience you have had in other places?—I have found Glasgow better that any Continental place in which I have used the telephone.

What is your experience of the telephone service?—It is not so good that it might not be better, and it is not so bad that it might not be worse.

As to the Corporation getting a license, witness said he thought that the proverb of "Too many cooks spoil the broth" held good in regard to telephony the same as in other matters. He looked on the telephone as an adjunct to the telegraph, and it ought to be in one hand. Having explained that the membership of the Chamber of Commerce was 986, he said that the members by a large majority had declared against the Corporation taking over the telephone.

Mr. Ure: Does this express your view about the telephone. "It is neither a comfort, nor a pleasure, nor a luxury, but has become a necessity?"—It has.

Do you ever have to wait to get connection?—I don't wait. I give it up. Life is too short. (Laughter.) The Paris system was in his opinion worse than Glasgow—it took an eternity before you could get through.

By Mr. Salvesen: I have expressed my opinion in public.

Did you say you did not doubt the ability of the Town Council to do what they promise?—I did not wish to throw any doubt on the ability of the Corporation.

The Commissioner: Have you any opinion?—Practically, no.

Mr. Salveson: Is it your opinion that an additional system would bring in a great many new subscribers?—That would depend on the price.

If the price were £5?—Then, very likely.

Do you think that would be a disadvantage?—To me personally, yes. I am not a Socialist. I prefer a carriage to an omnibus.

You prefer the telephone restricted as it is at present?—If every person in Glasgow had a telephone life would be quite unbearable. (Laughter.)

You think the telephone system has attained sufficient development as regards the number of subscribers?—I can speak to all the people I want to speak to.

Any increase would be a disadvantage?—If the attention given to me personally is diminished, certainly it would be to me. It may be selfish, but that is so.

Your view is that the Government should take the lines?—Certainly. I am not aware that the Government can't interfere until 1911.

If you are told that the only choice is between the Corporation getting a license, so as to enable them to give an efficient service, and the National Company remaining until 1911 masters of the situation, with the right to charge whatever they pleased, what would you say as to the choice between the two?—I am not aware that they can charge anything they please. Of two evils, I would choose the lesser, and that might be the Corporation.

John Yuile, assistant manager of the *Evening Citizen*, deponed that the *Citizen* had subscribed to the telephone since the introduction of the system. The service had been found fairly satisfactory.

Archibald Colville, in reply to Mr. Scott Dickson, said he was a member of the firm of David Colville & Sons, Motherwell. They had three instruments in Glasgow and four in Motherwell. They paid £180 a year. On the whole, he considered that the Telephone Company had attended to their wants fairly well. He wished that the system should be in the hands of the Government, and not in the hands of the Corporation.

David Anderson, managing clerk to James Gardner, Glasgow, and George Gibson & Co, Glasgow, examined by Mr. Balfour, said these two firms had telephones from the National Company—four in Glasgow and five in Leith, for which they paid £78. Taking everything into account, he thought the service was very satisfactory. He found the call wire an improvement on the old system. Connection was got more readily, and a conversation was less liable to interruption. He made large use of the trunk wires to London and intermediate places. Including rentals, the cost was £240 a year, and he believed the firms got full value for the money. It would not be an advantage to have two systems in Glasgow. Saw no reason why the Corporation should not give the company the right to place the wires underground.

By Mr. Ure: We have had complaints to make against the company. They are too numerous to specify.

By the Commissioner: Though I have made frequent complaints, I don't think the service inefficient. We complained perhaps once in three weeks.

Andrew Jackson, Kirkpatrick, deposed that his firm carried on business at Glasgow, Newcastle, and London. They had two telephones in the Glasgow office, he had one to his house, and he had one in each of the other places. The service was very fair. He believed it would be improved if the wires were put underground, and he was in favour of the Corporation giving the companies facilities to lay their wires underground. He objected to the Corporation starting a competing system.

George Clunas, manager of the Kinning Park Co-operative Society, deposed that the society had one exchange telephone and 38 private wires. He regarded the service as efficient, though everything could be improved.

Alexander Watt, shipping superintendent for Archibald Russell, coalmaster, deposed that the firm were large users of the telephone. They found the service efficient, and he would object to the introduction of another system. It would entail confusion, and large users would require to subscribe to both systems. The trunk service had decreased in efficiency since it was taken over by the Post Office.

George Pate, commission salesman to the Carron Coal Company, deponed that the company had two exchange wires and one private wire. They found the service efficient. Generally, he concurred in the evidence of the previous witness, and in reply to the Commissioner, he said that the trunk service was not so satisfactory now as when it was in the hands of the company. Too little time was allowed for the details of the company's business, and the result was that they had to erect a private wire.

(To be continued.)

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS.—1897.

[*Compiled expressly for this journal by* W. P. Thompson & Co., *Electrical Patent Agents, 322, High Holborn, London, W.C., to whom all inquiries should be addressed.*]

23,267. "Improvements in apparatus for the electro-deposition of one metal on another." J. E. Bryant. Dated October 11th.

23,296. "Improvements in indirect regulation of dynamo-electric machinery." W. Fairweather. (The Crocker-Wheeler Electric Company, United States). Dated October 11th.

23,304. "Improvements in magnetic circuit and its use." R. Wood. Dated October 11th.

23,329. "Improvements in and connected with substances to prevent polarisation in electric batteries." G. Platner. Dated October 11th. (*Complete.*)

23,332. "Improvements in secondary battery plates or electrodes." E. A. Paris. Dated October 11th.

23,342. "A combined electrical alarm and automatic switch." F. C. Bourne and J. G. Stidder. Dated October 11th.

23,352. "Improvements in the manufacture of electrodes for electrolytic processes." A. Zimmermann. (The Chemische Fabrik. auf Actien vormals E. Schering, Germany.) Dated October 11th.

23,369. "An improvement in electric safety fuses." H. C. Gover and C. F. Proctor. Dated October 11th. (*Complete.*)

23,415. "Improvements in dynamos." J. Liddle. (E. W. Farnham, United States.) Dated October 12th. (*Complete.*)

23,418. "Improvements in electromotors and dynamos." T. B. Murray and G. Johnston. Dated October 12th. (*Complete.*)

23,422. "Improvements in electro-magnetic clutches." W. G. Heys. (The Singer Industrial Company, United States.) Dated October 12th. (*Complete.*)

23,442. "Improvements in electrolytical current-directing devices and transformers." J. Y. Johnson. (Charles Pollak, Germany.) Dated October 12th.

23,470. "Improvements in electric incandescence lamps and apparatus or appliances in connection therewith." Walter Nernst. Dated October 12th.

23,489. "Improvements in electric storage cells." C. P. Elieson Dated October 12th.

23,513. "Improvements in telephone receivers and the like." G. A. Nussbaum. (La Societe Industrielle des Telephones, France.) Dated October 13th.

23,514. "Improvements in or relating to electric tramways or railways." J. McKenny and A. E. Porte. Dated October 13th.

23,530. "Improvements in bicycle holders and their combination with electrical contact makers." F. E. Stuart and A. P. Ford-Moore. Dated October 13th.

23,602. "Improvements in anodes of electro-decomposing apparatus." E. J. J. B. Benoit. Dated October 13th.

23,623. "An improved process of manufacturing electric incandescent lamps." C. Howard and R. Mayer. Dated October 13th.

23,625. "An electric time switch." A. J. Wheatley, J. M. James and T. B. Browne. Dated October 13th.

23,680. "Improvements in and relating to dynamos and electric motors." J. E. Liardet. Dated October 14th.

23,681. "Improved mechanism for operating or controlling electrical motors at a distance." G. Martinez. Dated October 14th.

23,705. "Improvements in electric motor engines." C. B. Callow. Dated October 14th.

23,713. "Improvements in dynamo-electric machines." R. Fabian. Dated October 14th.

23,792. "Improvements relating to the electric propulsion of vehicles." F. W. Schneider. Dated October 15th. (*Complete.*)

23,858. "A method for winding flexible electric wires." C. T. A. Henshaw. Dated October 16th.

23,886. "Improvements connected with electric motors and in the manner of connecting batteries to same." F. O'Connor Prince. Dated October 16th.

23,896. "A high and low water alarm (electrical)." F. Proctor. Dated October 16th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., *price, post free,* 8½*d.* (*in stamps*).]

1896.

10,284. "A new and improved reflector in connection with glass bulbs or glow lamps for electric lighting." G. W. Pridmore, T. J. Sturgeon and E. Yorke. Dated May 14th, 1896. Relates to incandescent electric lamps, which are provided with reflectors by winding on the bulbs, silver, aluminium, or other bright non-tarnishing wire, or glass thread which may be tinted. The coils are secured with soluble glass and coated with a protected paint or varnish. Glass thread is [wound on in a hot state and may be afterwards silvered. 2 claims.

10,414. "Improvements in electric hoists." W. H. Scott. Dated May 15th, 1896. Relates to electrically actuated cage lifts. The motor, which is of the series wound type, has in its circuit a solenoid, the core of which is connected to the levers of the brake blocks, so that when no current is flowing the latter are on, but they are taken entirely off or partially so when the current flows. By this arrangement, should the speed become excessive and the current therefore diminished the brake is automatically brought into action. When the switch is operated to reverse the motor an additional coil also in series is put in the circuit, so that the minimum current necessary to prevent excessive speed is reduced. An adjustable resistance is also placed in the circuit of the additional coil. 1 claim.

10,718. "Improvements in the manufacture of positive lead electrodes for electric accumulators." H. O. Tudor. Dated May 18th, 1896. Plates or electrodes are manufactured by charging lead plates which may have a thin coating of lead oxide or salts thereon as positive electrodes in very weak sulphuric acid for the purpose of forming a layer of lead oxide containing sulphate. The charging at this stage is intermittent. The plates are then reduced in the same solution by charging them as negative electrodes, and these are finally reconverted into positive electrodes by continually charging and discharging in stronger acid than that previously employed. 1 claim.

11,232. "Improved electric current conducting apparatus for electric railways." C. P. Steadenbach and O. H. Linken. Dated May 22nd, 1896. Relates to electric railway systems. Conductors, switches:—The contact pin is pressed inwards by the action of the collector bar on the roller, so as to complete the circuit with the main conductor. The contact is made with a glass lining and leather washers. Insulated guide rollers are placed on the other side, but they may be replaced by similar contacts for the return circuit. Collectors:—These consist of shanks hung on hinges under the vehicle, with guide rollers and conducting strips only where the bar bears on the roller. 2 claims.

11,338. "Improvements in electrodes for electrolytic purposes." E. A. G. Street. Dated May 23rd, 1896. Cathodes for use in electrolysing substances which produce a solid deposit thereupon, are each formed of a thin sheet, preferably of metal, wound one or several times upon itself. When it is required to remove the deposit therefrom the coil is further wound so as to reduce its diameter, whereby the film is detached. The cathode resumes its original form again by its own elasticity. 1 claim.

11,617. "An improved electric alarm for railway trains and other purposes." H. Binks. Dated May 28th, 1896. Relates to electric bell alarms, such as are used on railway trains to communicate between the passenger and guard, &c., in which the electric circuit is completed by a spring actuated stud when the glass front of the alarm box is broken. To prevent waste of battery power after the alarm has been operated, the alarm box is provided with a pivoted haw or bridge-piece, which is used to hold the contract stud in its depressed or open position after the glass has been broken. 3 claims.

11,732. "An improved plate for storage batteries." F. Grunwald Dated May 29th, 1896. Relates to electrodes for secondary batteries, which are made up of three plates, the central plate being provided with apertures, strips, tongues, ribs, &c., to hold the active material and two side plates having aperatures to receive the active material. The plates are held in place by lugs on the central plate, but so that the side plates can move slightly to allow for expansion of the active material. 1 claim.

11,801. "Impovements in sockets or holders for electric incandescent lamps." J. Katzenstein. Dated May 30th, 1896. Relates to holders for incandescent electric lamps which consists of a porcelain body and a cover (screwed on a nipple) screwed together and enclosing an insulating disc. For a screw capped lamp a metal socket made with an internal flange and a central contact disc are secured to the insulating disc by three screws inserted in it, two of them passing through into metal projections to which the conductors are secured. For a bayonet joint lamp slots to receive the studs on the clamp cap are made in the sides of the body and the insulating disc carries ordinary spring contacts. 3 claims.

11,858. "Improvements in partable electrically driven pumps." J. C. Merryweather. Dated June 1st, 1896. Relates to a pump driven by an electro-motor combined with a portable cistern. This combination forms a domestic pumping engine for fire extinguishing, the motive power being taken from the electric wires fitted to the house for lighting purposes. In the event of the electromotor failing to act, a toothed wheel is thrown out of gear, and a winch is attached to the wheel to enable the pump to be worked by hand. 2 claims.

1897.

15,623. "Improved mouthpiece for telephones, speaking tubes, and the like." K. Bolz. Dated June 30th, 1897. Relates to a portable mouthpiece for telephones and the like, which prevents the transmission of diseases, and consists of an annular plate or frame over which is stretched or placed a perforated fabric or plate, and is provided with hooks or similar devices of suspension so as to fix the frame to the speaking funnel. 2 claims.

15,513. "Process for producing peat charcoal by means of an electric current. C. A. Jensen. (P. Jensen, Norway.) Dated June 29th, 1897. Relates to a process for producing peat charcoal which is characterised by inserting the peat as a resistance in an electric circuit. Thin layers of dry peat are used and by the aid of a roller machine, or press, the pistons of which carry the conducting wires, or themselves form the poles, the evaporation of moisture quickly takes place. 1 claim.